1014

MODERN SOVIET WARPLANES

FIGHTERS & INTERCEPTORS

by Steven J. Zaloga

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COLOR

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Front Cover

A MIG-29 Fulcrum at the 1990 Farnborough air show. During this display, the aircraft was fully armed with R-27, R-60 and R-73 missiles. (S. Zaloga)

Back Cover

A Czechoslovak MIG-29UB trainers of the 11th Fighter Regiment taxis forward at its base in Bohemia. (Yves Debay)

This book aims to provide a photographic survey of recent Soviet fighter and interceptor aircraft with a special emphasis on detail views useful for aircraft modelers. In decades past, Soviet aircraft have been veiled in mystery due to the extremes of Soviet military secrecy. With the recent political changes occurring since the mid-1980s, this has begun to change. The arrival of a pair of MIG-29 Fulcrums at the Farnborough Air Show in 1988 was the first tangible sign of aerospace *glasnost*. The majority of the photos in this book were taken by the author at the Farnborough Air Show in 1988 and the Paris Air Salon at Le Bourget in 1989. Rather than confine the book to the MIG-29 and Su-27 displayed in the West, coverage was extended to other contemporary fighter types such as the MIG-31, and MIG-23 with the hopes of supplementing existing publications with new photos and coverage of newer variants.

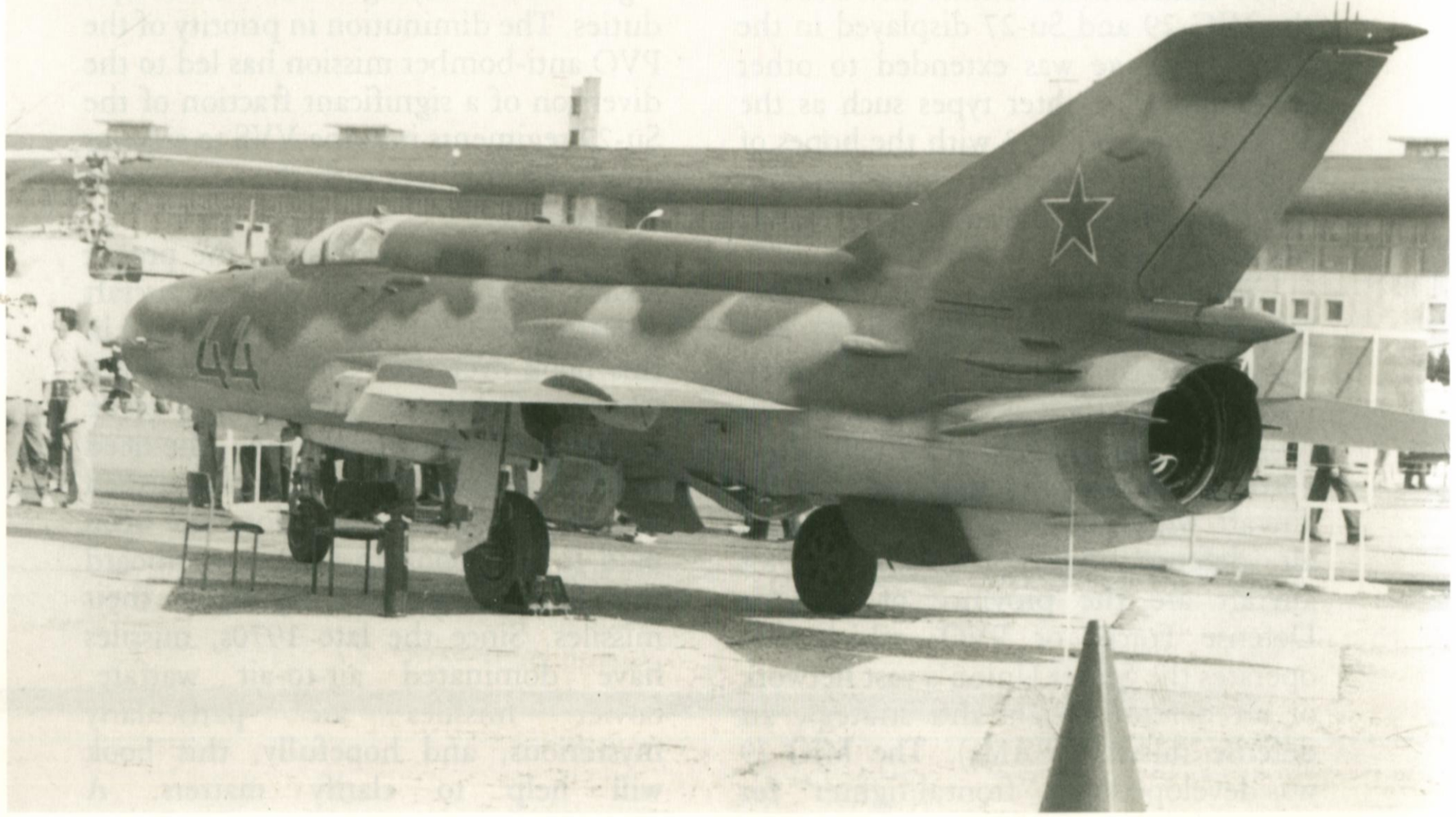
Why do the Soviets acquire two fighter aircraft such as the Su-27 and MIG-29 at the same time? It is often forgotten that there is not one Soviet air force, but two. The Soviet VVS, or Air Force, encompasses tactical and strategic aircraft with the exception of strategic air defense interceptors. Interceptor aircraft are the province of the Air Defense Force, or PVO, which also operates the Soviet Union's vast network of air defense radars and strategic air defense missiles (SAMs). The MIG-29 was developed as a "frontal fighter" for the VVS to replace the earlier MIG-23. It is intended to carry out tactical air superiority missions, tactical air defense, and if need be, ground attack missions. In contrast, the Su-27 was developed on the basis of a PVO requirement for a long-range interceptor, capable of engaging either strategic bombers, or strategic cruise missiles. It was intended to replace an earlier Sukhoi design, the Su-15 Taifun (Flagon).

Ironically, changes in the organization of the VVS and PVO in the late 1970s and early 1980s muddled these distinctions. The amalgamation of PVO and VVS fighter regiments in some military districts has resulted in MIG-29 regiments carrying out PVO-style duties. The diminution in priority of the PVO anti-bomber mission has led to the diversion of a significant fraction of the Su-27 regiments into the VVS to serve as long-range fighters with the operational air armies.

As the reader will note, the proper Soviet designations for various aircraft and their weapons has been preferred in this book over the NATO designations when available. As *glasnost* has made the Soviet military more open, the need for NATO condenames has diminished somewhat. Special attention has been paid in this book to weapons onboard the Soviet fighters, especially their missiles. Since the late 1970s, missiles have dominated air-to-air warfare. Soviet missiles are particularly mysterious, and hopefully, this book will help to clarify matters. A companion volume to this book covers strike, bomber and attack helicopters of the contemporary Soviet Air Force.

The author would like to thank several friends and colleagues who provided photos for this book. Special thanks go to Nick Cook, who provided many of the interesting views of aircraft at the 1989 air show at Khodynka. Thanks also go to Christopher Foss, for his unique photos of Iraqi aircraft, and to Wojciech Luczak. Thanks also go to Vika Edwards of Sovfoto/Eastfoto for help in locating photos from Soviet sources. The author would also like to acknowledge the help provided him by friends in the USSR and Finland.

One of the new features displayed on the Khodynka MIG-21bis was this external cover on the right side of the fuselage. It has been described as a refueling probe cover, although this is by no means confirmed. (Nick Cook)

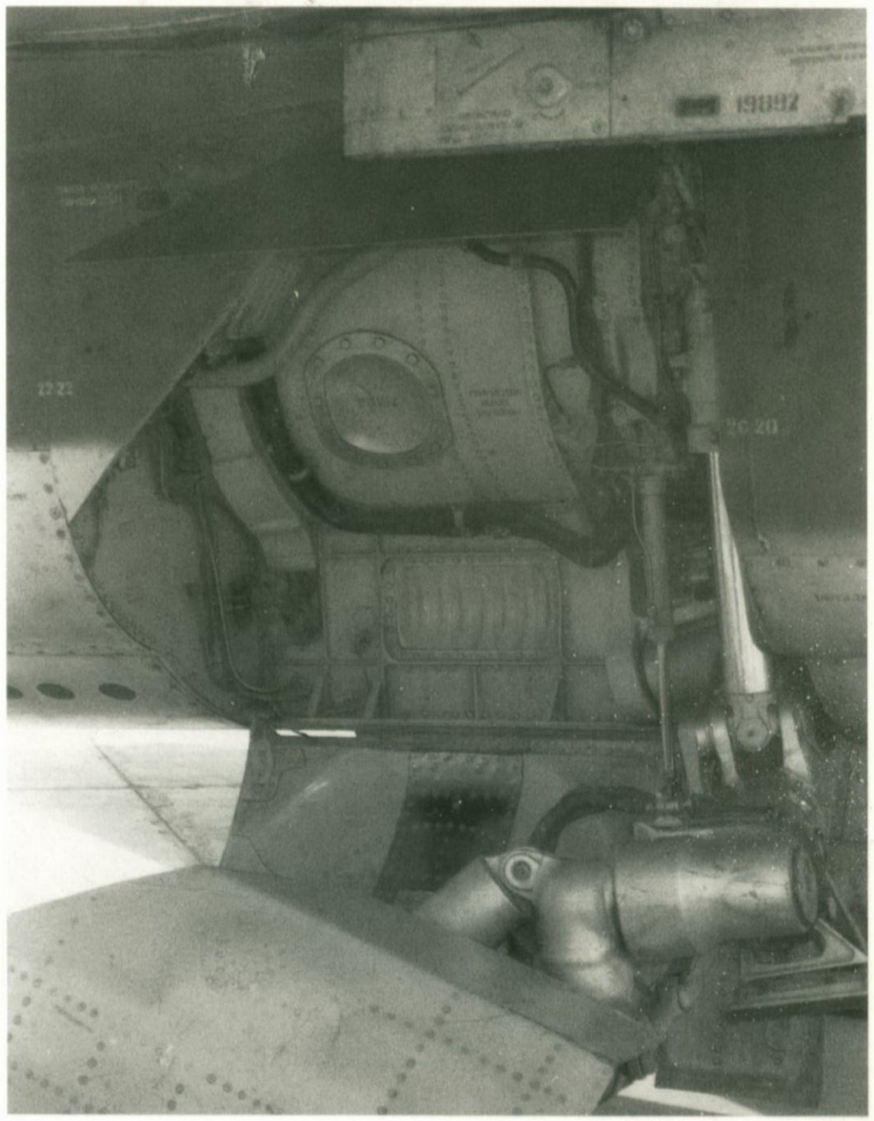


Long the staple of Soviet fighter regiments, the MIG-21 is only now beginning to fade from the scene. This late production MIG-21bis was displayed in 1989 at Central Frunze Airfield at Khodynka, outside Moscow. It is in a threetone camouflage scheme of tan, dark brown and dark green over a medium sky blue undersurface. Only two regiments, about 85 MIG-21, remain in service as tactical interceptors with the VVS as of 1990. (Nick Cook)

▶ A Soviet MIG-23UM twin-seat trainer slides in for a landing. The MIG-23 remains the principal Soviet tactical fighter, with over 700 in service in 1990. In addition, about 900 serve in the interceptor regiments of the PVO and a further 725 fighter/bomber derivatives with the attack regiments of the VVS.

▼ A MIG-23BN (Flogger H) fighter-bomber of the Support Command, Iraqi Air Force near Baghdad in 1989. It is believed that the Iraqis operate two regiments (about 70 aircraft) of this type. It is finished in a tan and brown camouflage scheme with the Arabic number 23173 on the nose. (C.Foss)

▼▶ A close-up of the wheel-well detail of the Iraqi MIG-23BN. The wheel well interiors of Soviet aircraft are usually finished in the same color as the aircraft undersurface. (C.Foss)



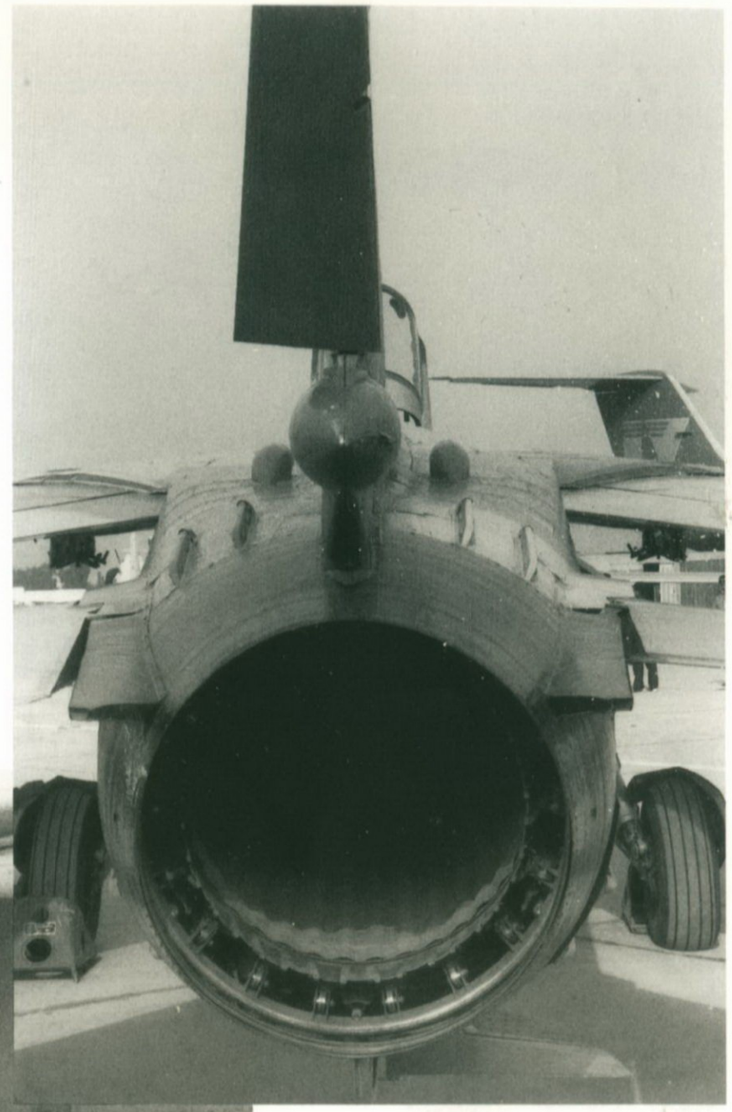
A view of the mid-section of an Iraqi MIG-23BN. The small pod on the leading edge of the wing is believed to be a missile guidance antenna, presumably for use with weapons such as the Grom (AS-7 Kerry). (C.Foss)

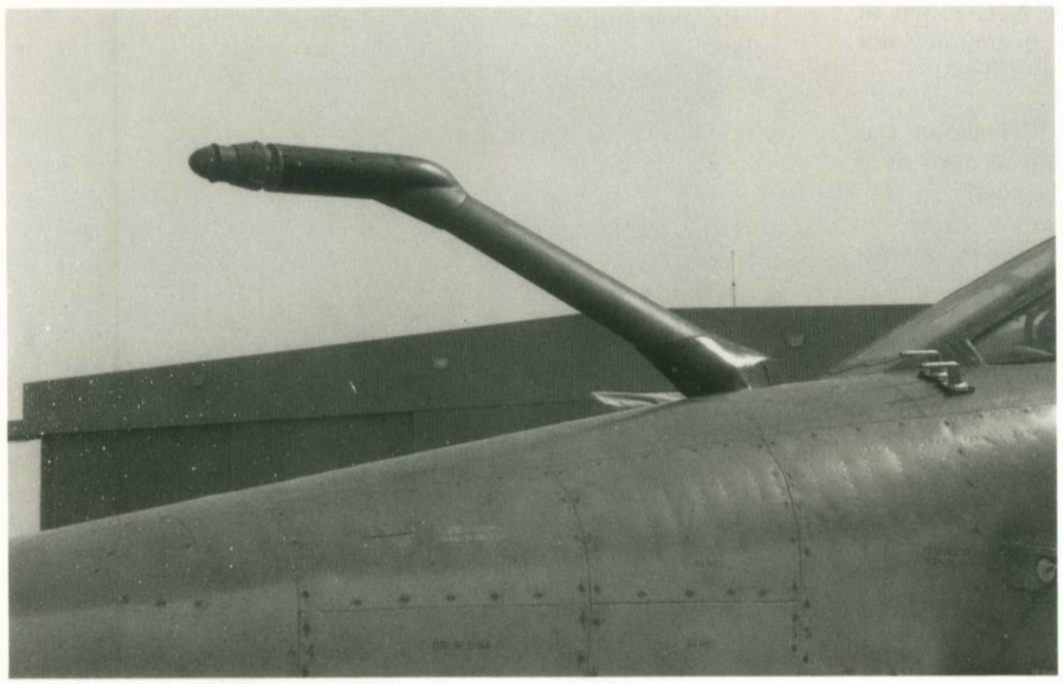
A rear view of the Iraqi MIG-23BN. The Iraqi national insignia is carried on the tail in the form of the national flag, while the fuselage side carries the Air Force triangle national insignia. (C.Foss)

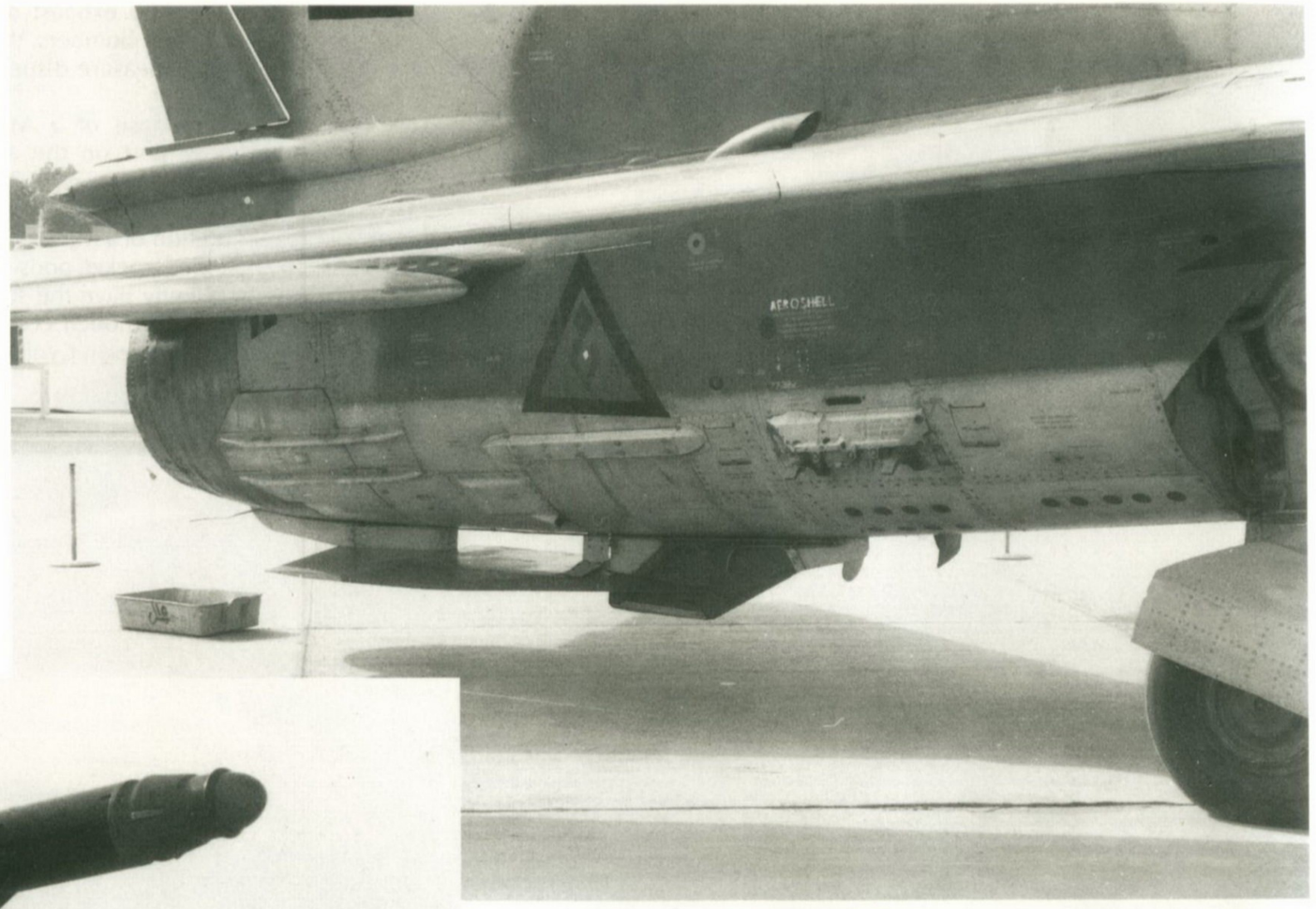
▶ A rear view of the engine exhaust of the MIG-23BN. In contrast to current Soviet fighter-bombers, this Iraqi aircraft is not fitted with ASO flare countermeasure dispensers. (C.Foss)

◀ This close up of the nose of a MIG-23BN shows the distinctive laser rangefinder port on the aircraft, as well as a refueling probe added to some Iraqi MIG-23s. (C.Foss)

▼ A view of the mid-section of a MIG-23BN. These pylons are the type used with unguided rocket pods and free-fall bombs. Soviet export aircraft frequently have the stencilling instructions in English rather than Russian, though confusingly, many small identification labels remain in Russian Cyrillic characters. (C.Foss)



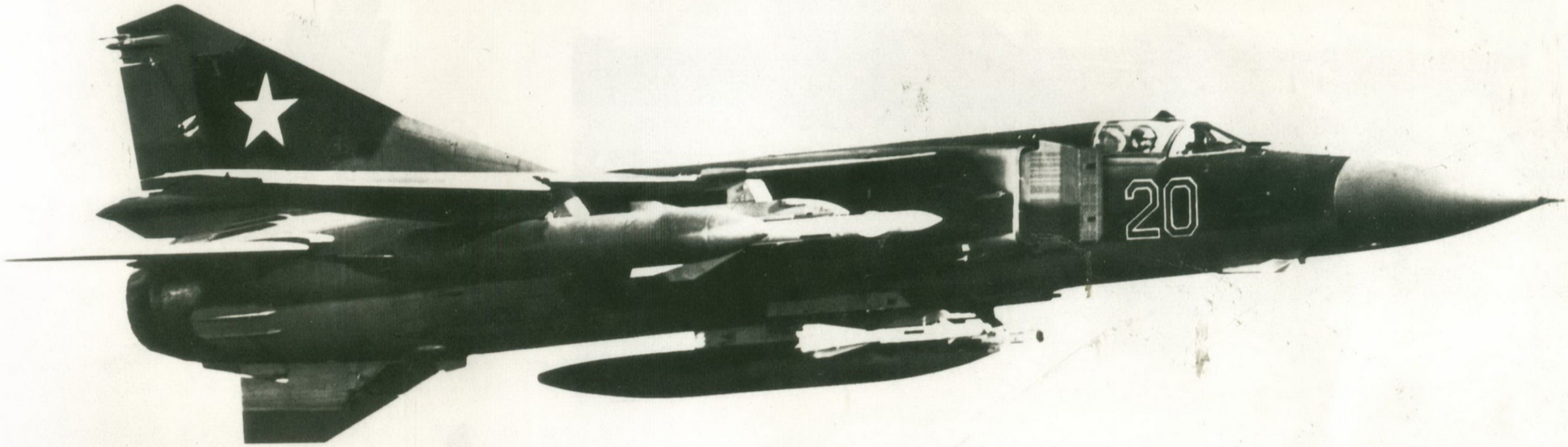




▲ A view of the rear area of a MIG-23BN of the Iraqi Air Force clearly showing the national insignia. The ventral fin folds up during landing. The shackles located immediately aft the landing gear doors are for bombs, usually the FAB-250 or FAB-500 bombs. (C.Foss)

◀ A close-up of the refueling probe added to some Iraqi MIG-23BNs. The Iraqis were not satisfied with the effective range of the MIG-23BN when carrying a full bomb load during the war with Iran. The refueling probes were added with the hopes of extending the range of the aircraft to hit more distant Iranian targets. (C.Foss)

◀▲ A view of the refueling probe from the left side. This effort was completed with the cooperation of western European aviation firms. (C.Foss)



Another MIG-23MLD out of Cam Rahn Bay. This photo highlights another improvement of the -MLD derivative, an additional stores pylon on the outer wing section, in this case being used with a fuel tank. This particular aircraft carries a somewhat unusual mixture of weapons, a standard R-23R (AA-7 Apex) on the APU-23M wing pylon, an R-60MK (AA-8 Aphid) on the right universal pylon and, curiously enough, a K-13M (AA-2 Atoll) on the left underbelly pylon. It is unusual for the Soviets to carry the AA-2 and AA-8 on neighboring pylons like this.

A MIG-23MLD (Flogger K) interceptor, operating with a regiment based out of Cam Rahn Bay in Vietnam in 1988. This is the most recent interceptor modification of the MIG-23 family and is characterized by improvements in the wing design for enhanced maneuverability. Although barely evident, this aircraft has a cartoon shark painted on the rudder, a most unusual practice by Soviet standards.

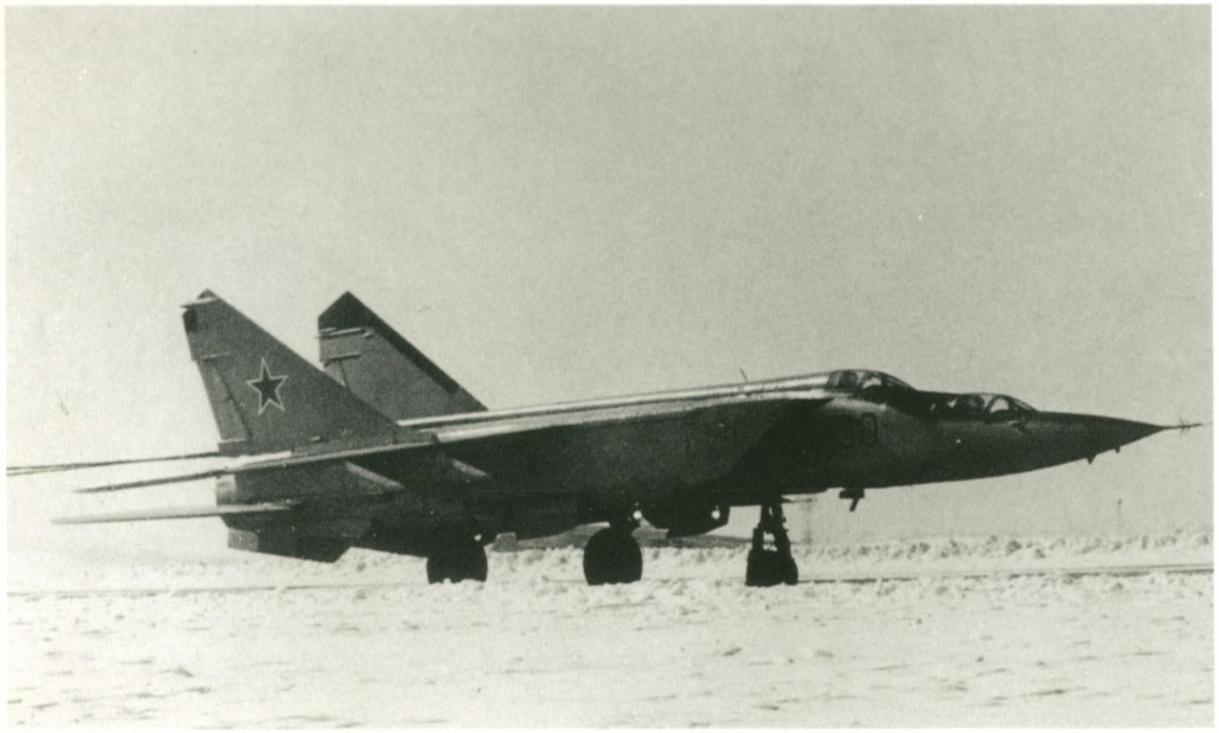
A rear view of the MIG-23ML at Khodynka. In this view, the four R-60 missiles have been removed. This aircraft was finished in a typical 1980s scheme of dark green, medium green and tan. (Nick Cook)

A MIG-25PD Foxbat E is the latest interceptor version. The MIG-25PD was characterized by a new search radar which permits limited look-down, shoot-down capability. It is still armed with the massive AA-6 Acrid air-to-air missiles.

▲ A view of an armed MIG-25PD Foxbat E. Typically, two of the missiles will be infrared-guided, the other two, radar-guided. The MIG-25PD can be distinguished from earlier models by the sensor fairing under the nose.

▲◀ A MIG-25PD Foxbat E interceptor on a landing approach. This underbelly view shows the dielectric panel of the new radar system. This particular aircraft is armed with a pair of AA-6 Acrid missile training dummies, evident by the prominent bands painted around their mid-sections. (Sovfoto)

◀ The MIG-25BM Foxbat F is a dedicated electronic warfare version designed to perform the "Wild Weasel" mission. For this role, it is armed with four AS-11 Kilter anti-radiation missiles, seen here under the wings.



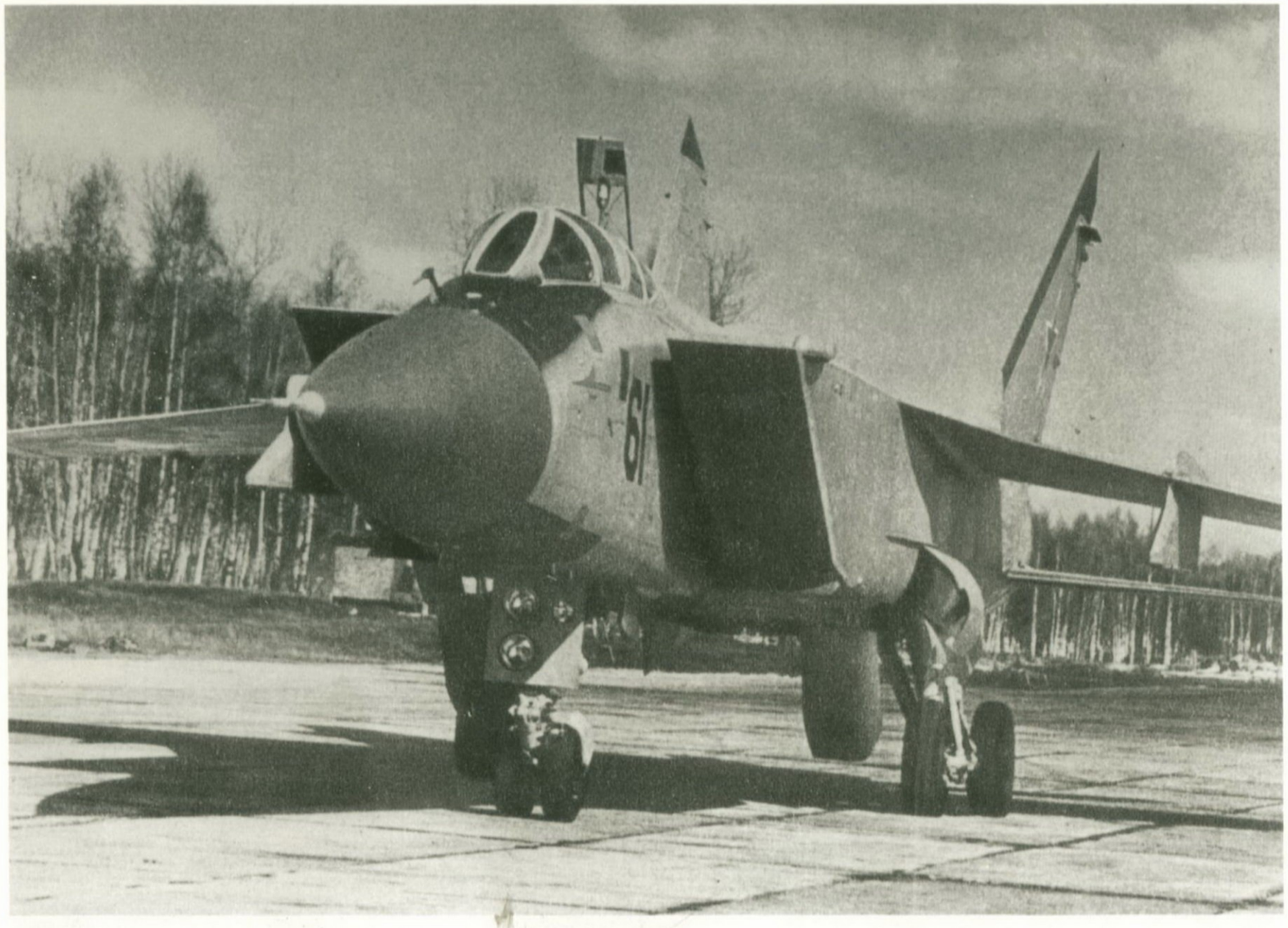
▲ The MIG-25RB is a reconnaissance version of the Foxbat family. It is fitted with cameras and side-looking radar for operational reconnaissance missions. This particular example was displayed at Khodynka in 1989. (Nick Cook)

▲◀ The MIG-25U Foxbat C is a training version of the Foxbat family with an additional station carved out of the space formerly occupied by the air search radar.

◀ Some idea of the size of the MIG-25PD can be gathered from this photo. The aircraft in the foreground is a MIG-25PD Foxbat E interceptor, and behind it is a MIG-25U Foxbat C trainer. (Sovfoto)

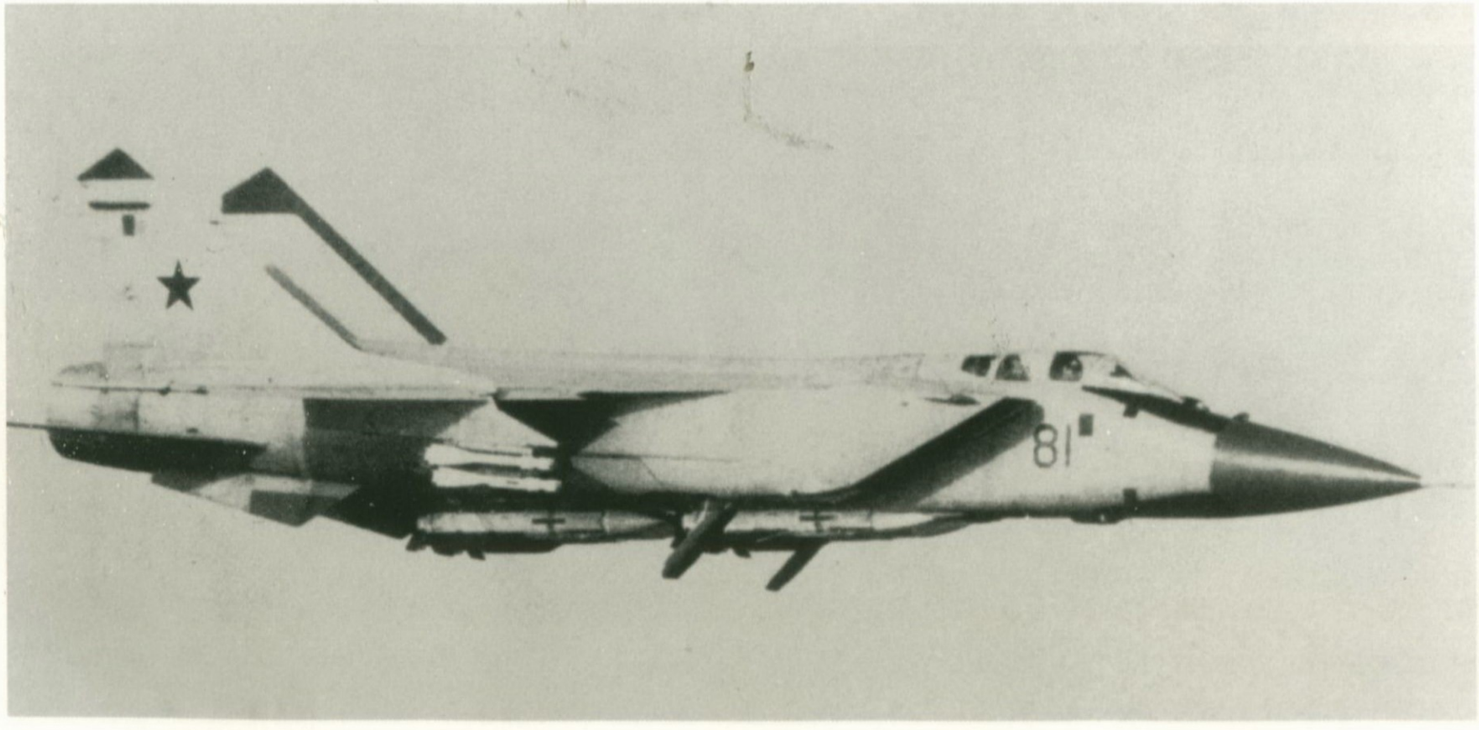
A left side view of the MIG-25RB at Khodynka in 1989.

The MIG-31 Foxhound PVO interceptor remains one of the least known of contemporary Soviet fighters, and has not yet been publicly displayed in the West.



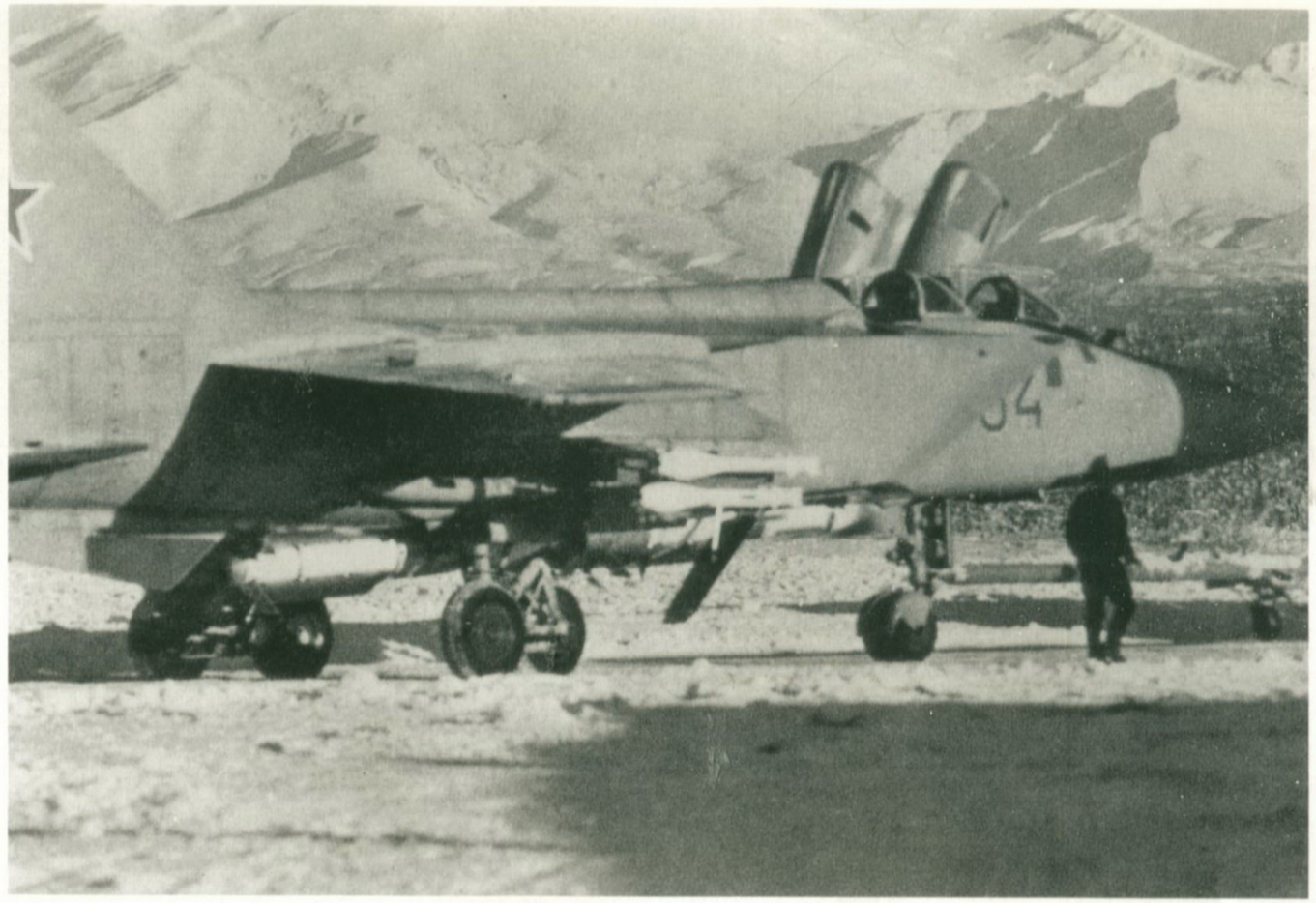
The crew of a MIG-31 Foxhound return from a typical patrol mission. The MIG-31 inventory numbered about 280 aircraft in 1990, about 8 regiments.

A pair of MIG-31 interceptors prepare for take-off. The heaviest concentrations of these aircraft so far has been in the Murmansk area north of Leningrad, and around Moscow.



◀▲ The successor to the MIG-25 in the strategic interceptor role is the MIG-31. This aircraft, preparing for a training mission, lacks the usual array of AA-9 Amos missiles on the underbelly stations. Note also the unusual staggered wheel configuration.

◀ A side view of MIG-31 Foxhound with its belly airbrakes open. This aircraft carries the typical armament load, four AA-9 Amos long-range missiles under the fuselage and four AA-8 Aphid (R-60MK) short-range infrared guided missiles on wing pylons. This MIG-31 is designed primarily for long-range interception of strategic bombers, and is not designed for dog-fighting.



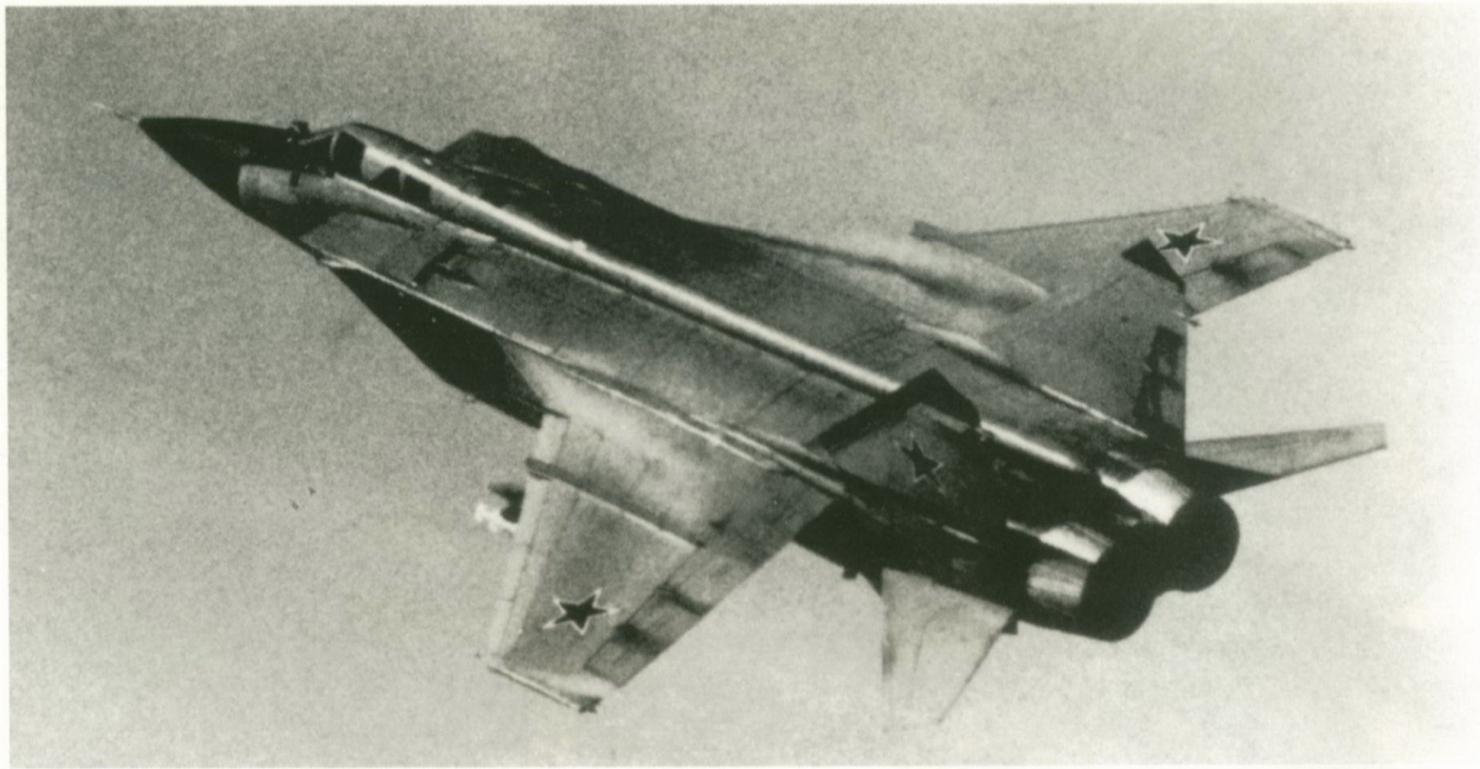
▲ This view shows how closely the MIG-31 resembles the MIG-25 which preceded it. For many years, it was believed that the MIG-31 was simply another MIG-25 variant. This view also clearly shows its general armament configuration. It does not carry a gun system, only missiles.

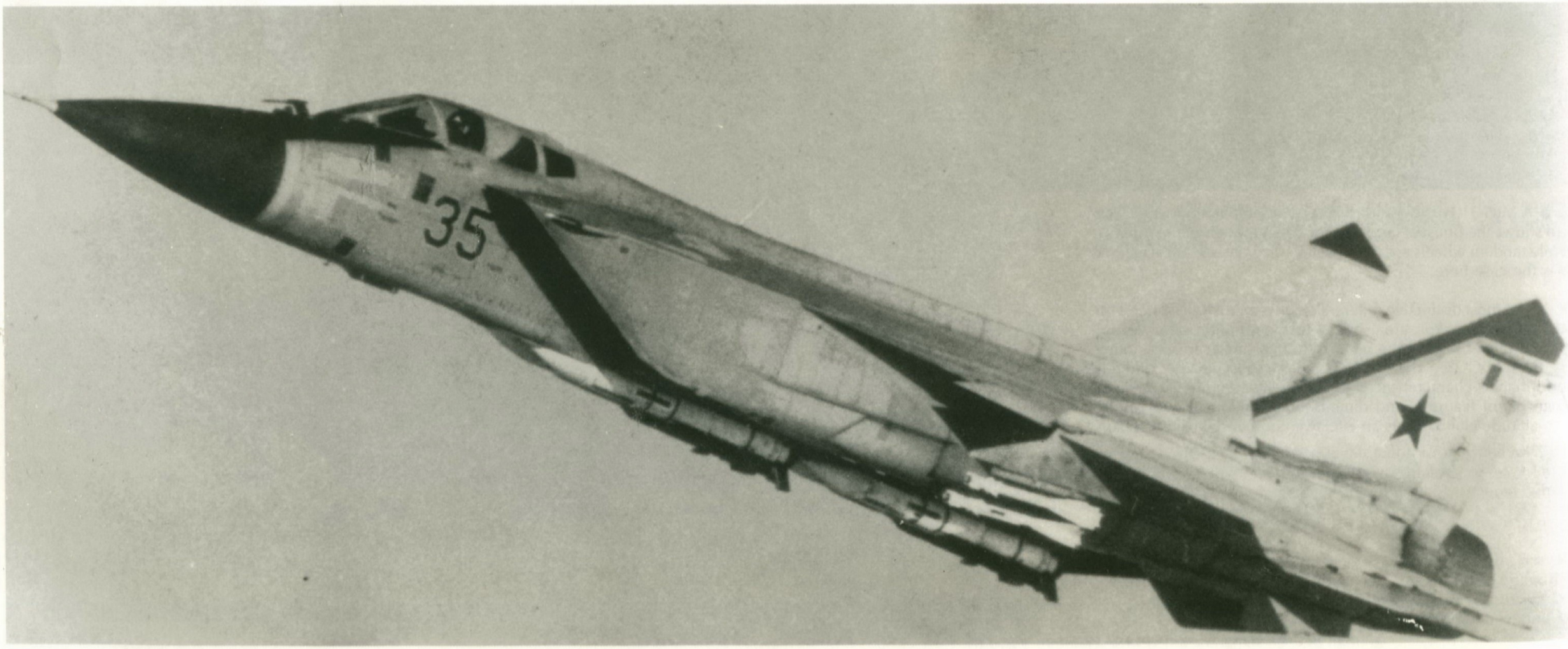
▲▶ A MIG-31 Foxhound during take-off preparations. This view also shows the unusual landing gear configuration of the MIG-31. While tandem wheels are not unusual, they are seldom staggered as is the case here.

▶ The most distinctive difference between the MIG-31 and the MIG-25 is its cockpit area, owing to the addition of a weapon systems officer behind the pilot. Although similar in appearance to the MIG-25, the MIG-31 has substantially different performance characteristics, with a greater emphasis on long-range patrol features, and diminished attention to high speed, high altitude climb. It has an effective combat radius of 2100km.

▶ A look over the tail of a MIG-31, accenting the long tunnel that leads back from the cockpit. This fairing ends in a cone which is likely to contain a braking parachute.

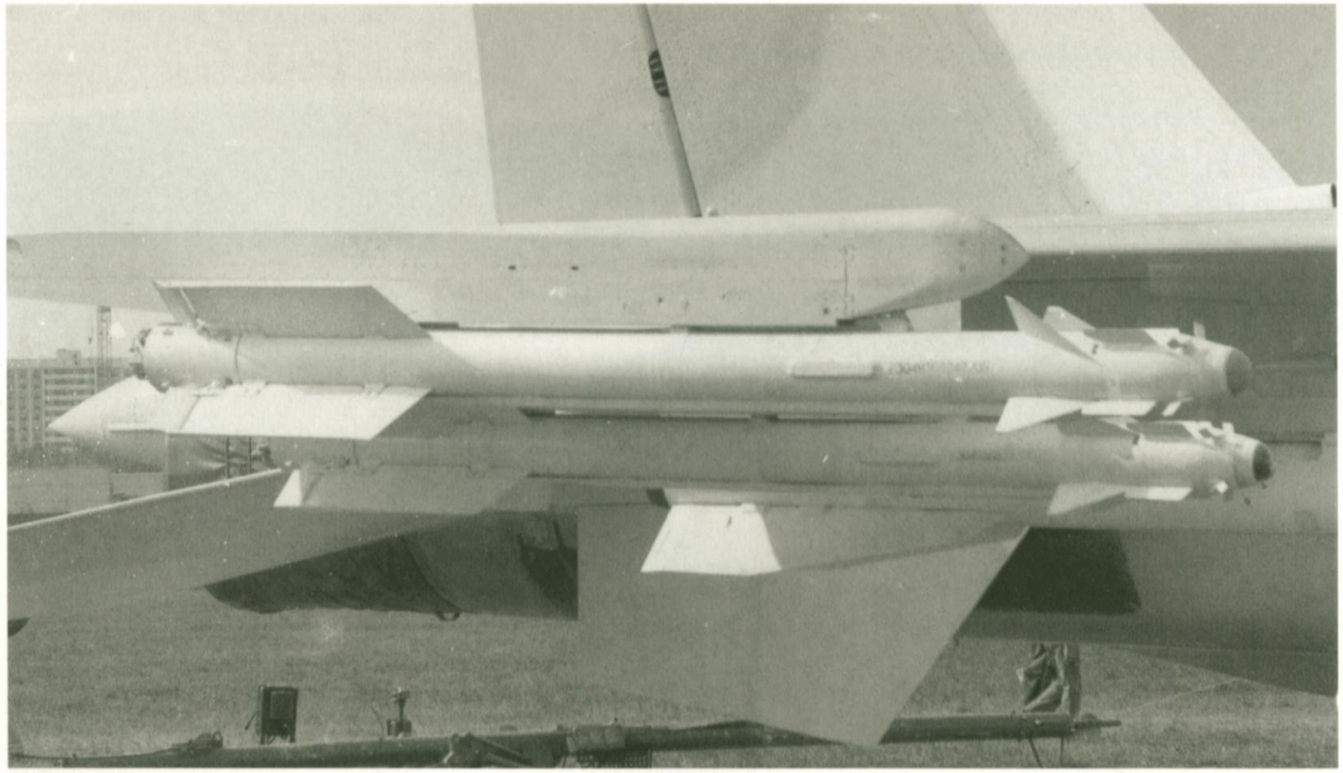
▼ The massive Pulse-Doppler radar in the Foxhound, codenamed Flash Dance by NATO, enables the MIG-31 to engage low flying strategic bombers. The MIG-31 was intended primarily for the interception of high-altitude strategic bombers, an increasingly irrelevant mission due to the shift of strategic bomber tactics in the mid-1960s to low altitude penetration.





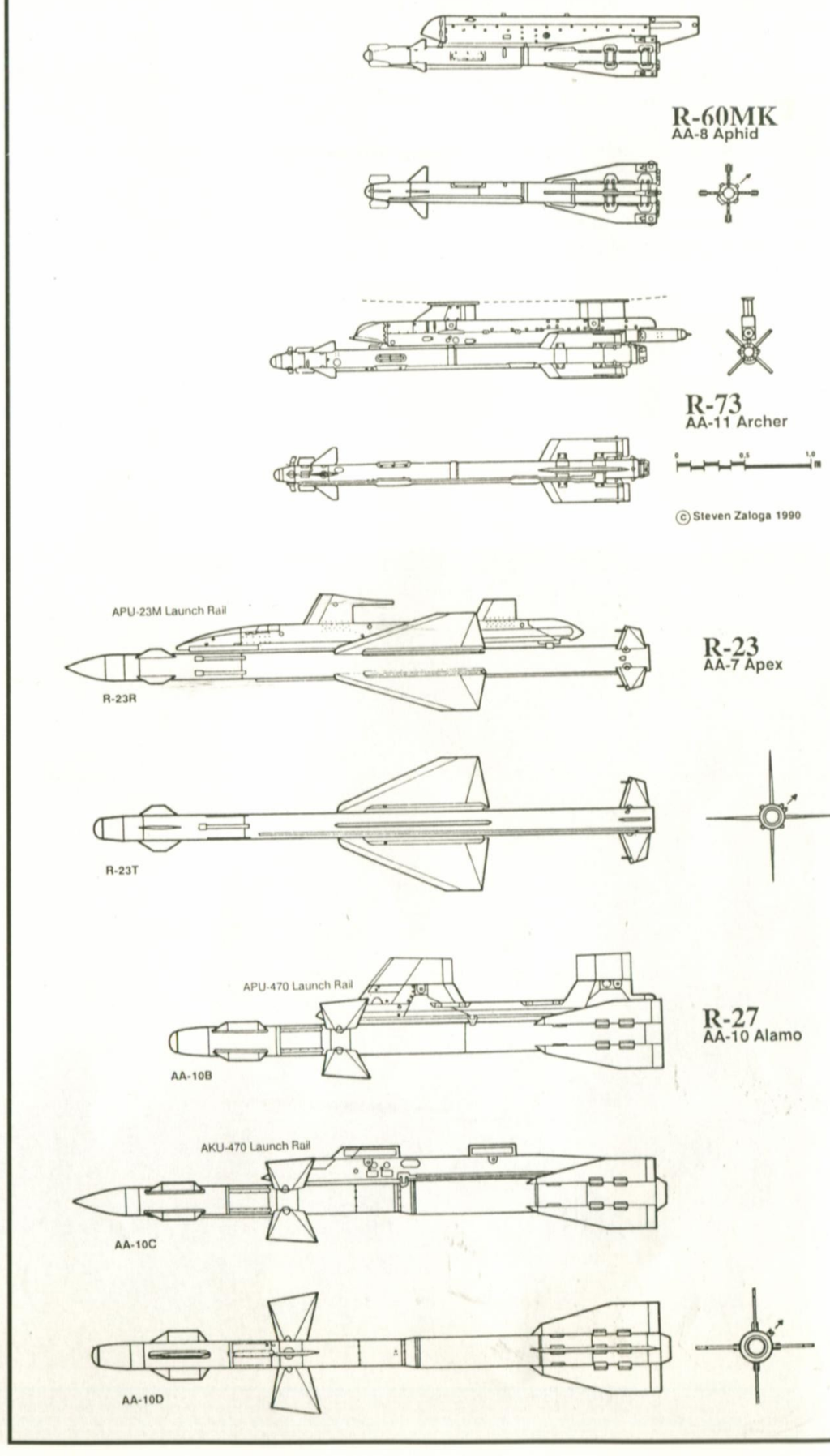
The R-23T is better known by its NATO codename, AA-7 Apex. It is a medium-range missile, comparable to early versions of the AIM-7 Sparrow. Unlike the American missile, it is available in both infared-guided (R-23T) and semiactive radar-guided (R-23R) versions. The R-23T seen here has a blunter nose due to its optical seeker. It is mounted here on a standard APU-23M launch pylon. The smaller missiles seen below are short-range infra-red guided R-60MKs, better known as the AA-8 Aphid. This small missiles have no direct technical counterparts elsewhere, being smaller and lighter than the common American AIM-9 Sidewinder. However, they are used in a role similar to the Sidewinder, shortrange dogfighting. (Nick Cook)

The R-27, also known as ''izdeliye 470'', is the successor to the R-23 for medium range engagements. Known to NATO as the AA-10 Alamo, there are four variants consisting of a short-range and long-range family each with a semiactive radar guided and an infrared guided variant. This particular example is the AA-10C Alamo, the long-range, semi-active radar guided version, mounted on the belly of an Su-27. (Nick Cook)



The successor to the R-60/AA-8 Aphid is the R-73 (AA-11 Archer). It is a short-range, infrared guided dogfight missile, designed for high levels of terminal maneuverability. It is seen here mounted on the outer pylons of an Su-27.

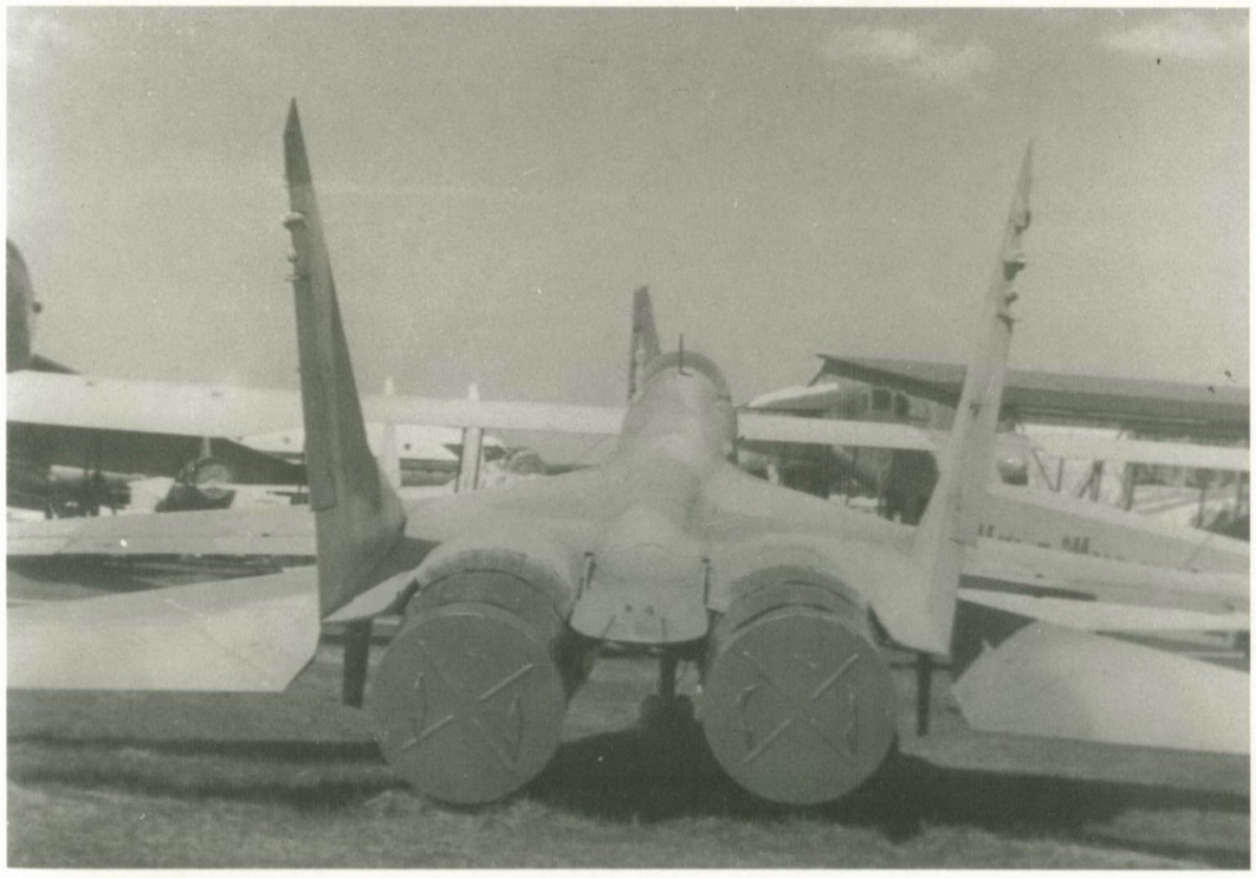
Another view of an R-73 (AA-11 Archer) on the outer wing pylon of an Su-27 interceptor. The profusion of fins on the nose section is peculiar to this design. These consist of an angle-of-attack sensor, stabilization fins and a final pair of moving guidance fins. (Nick Cook)

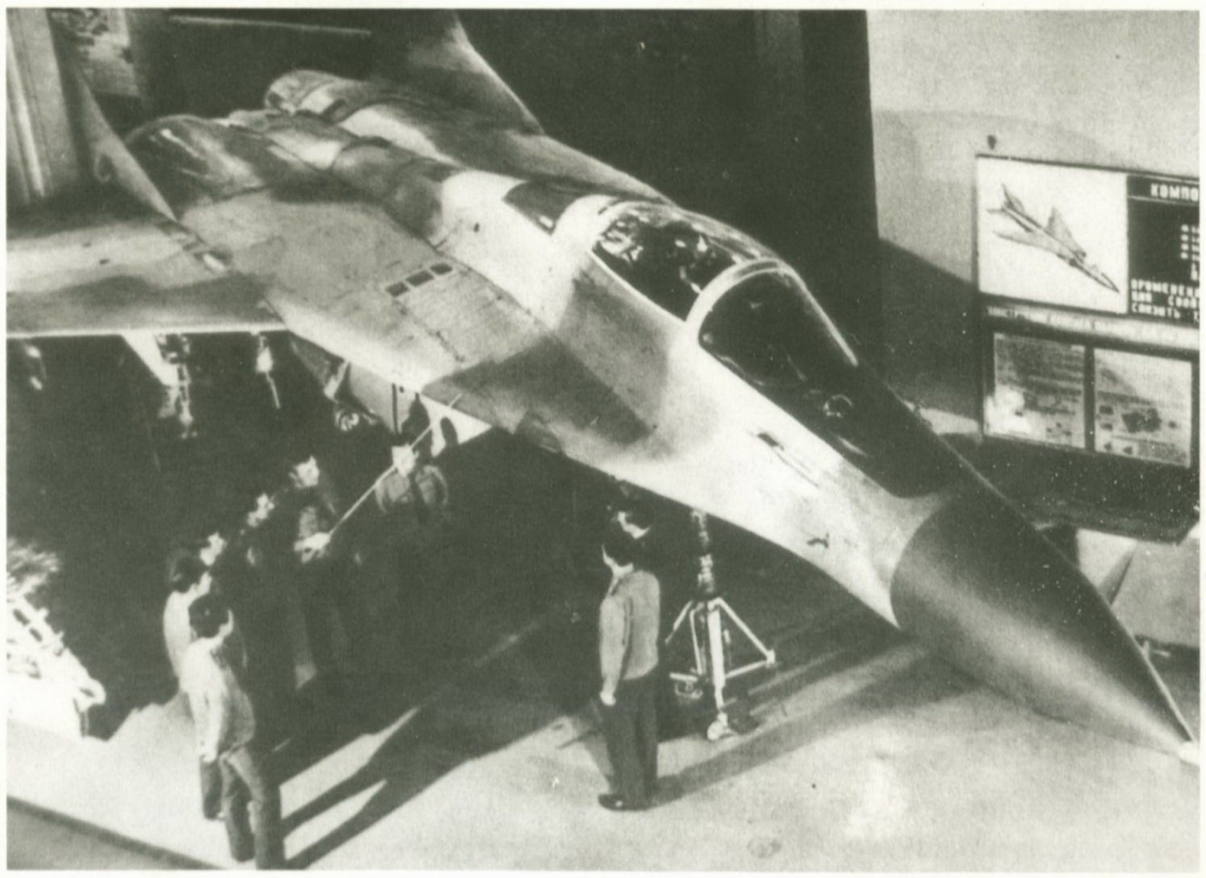


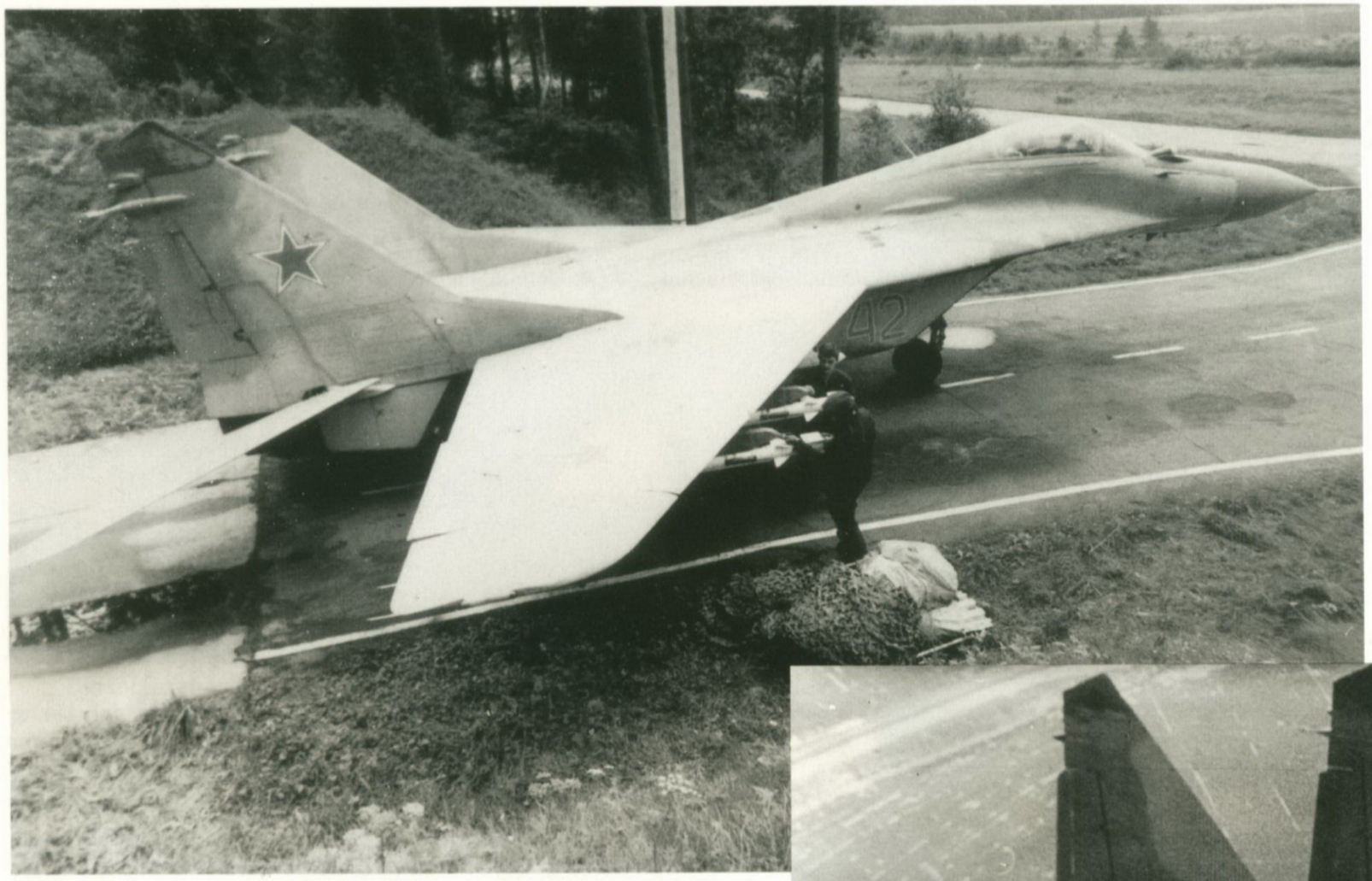
◀ The prototype of the MIG-29 Fulcrum, currently housed at the Soviet Air Force Museum at Monino. The prototype series differed from the production aircraft in many details, including the front landing gear configuration. (Hans-Heiri Stapfer)

▼ A pre-series production MIG-29 relegated to training duty. Several small details distinguish this production series, including the short vertical tail, spine communication antennas and parachute brake housing.

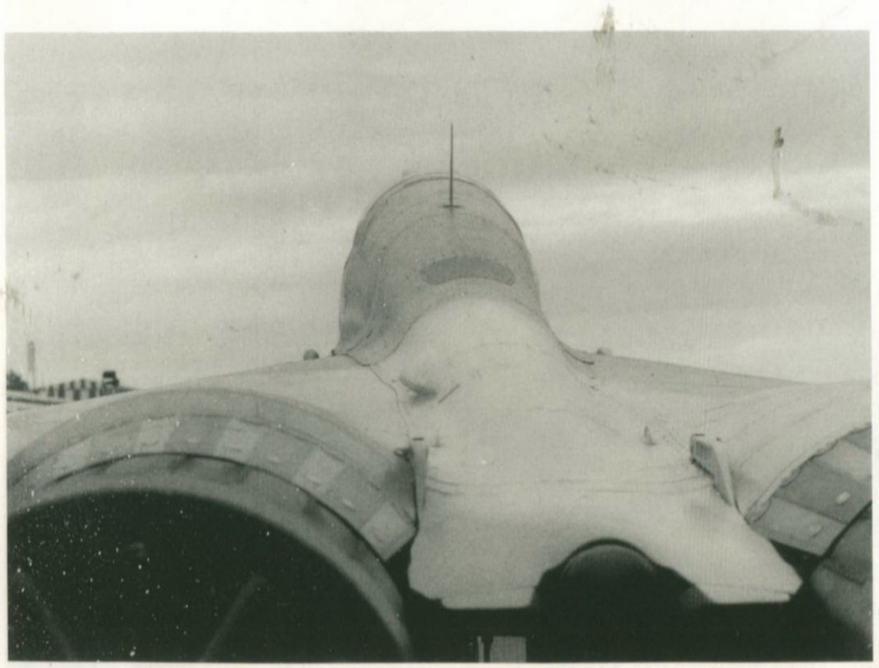
▼◀ The prototypes of the MIG-29 had this distinctive flat housing for the rear braking parachute. (Hans Heiri Stapfer)





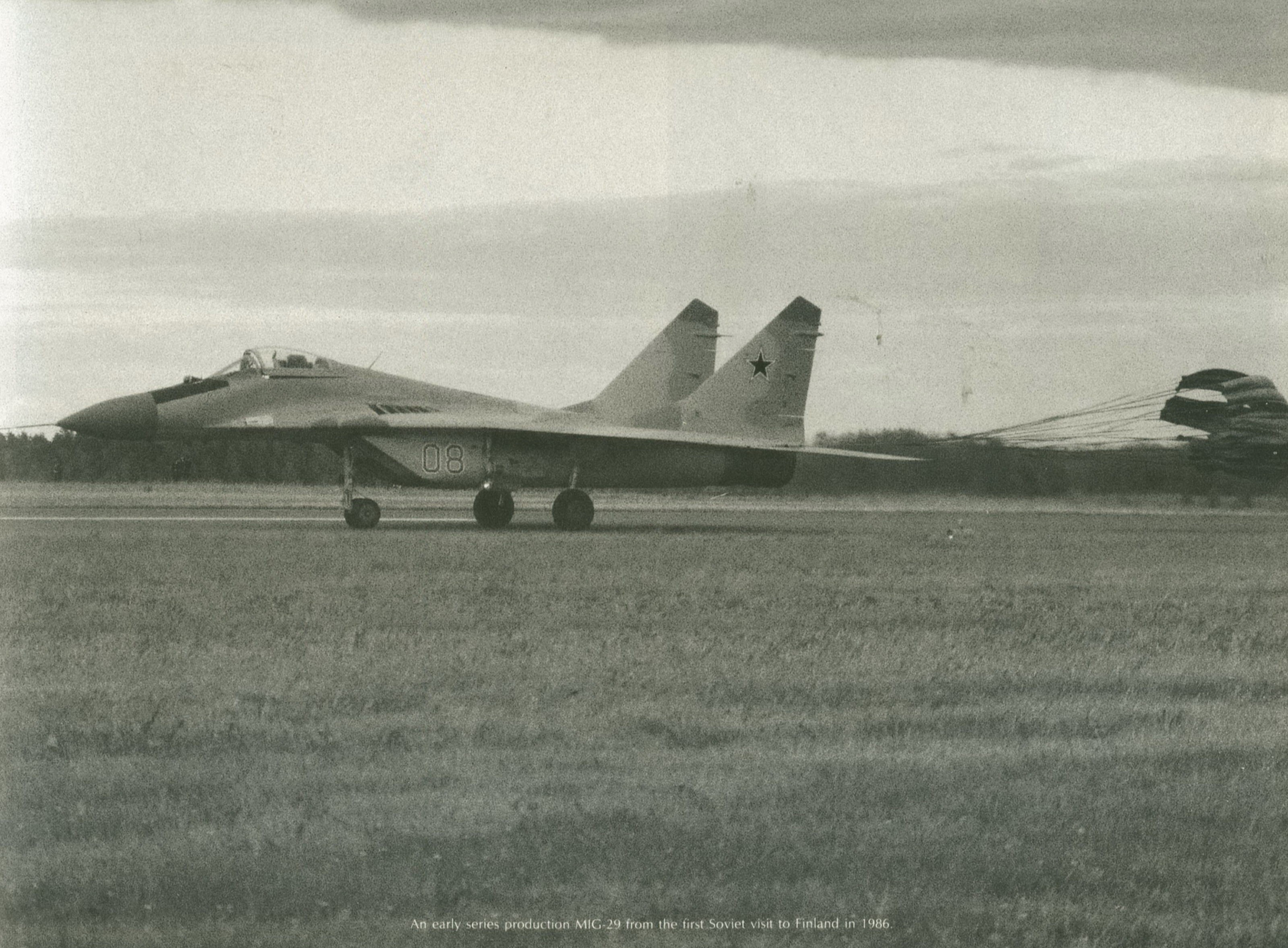


Another example of the early production MIG-29 called MIG-29 (9.12) by the Soviets.The view clearly illustrates the early style vertical tail, as well as the ventral fin. The ventral fin was also found on the prototype series. (Sovfoto)



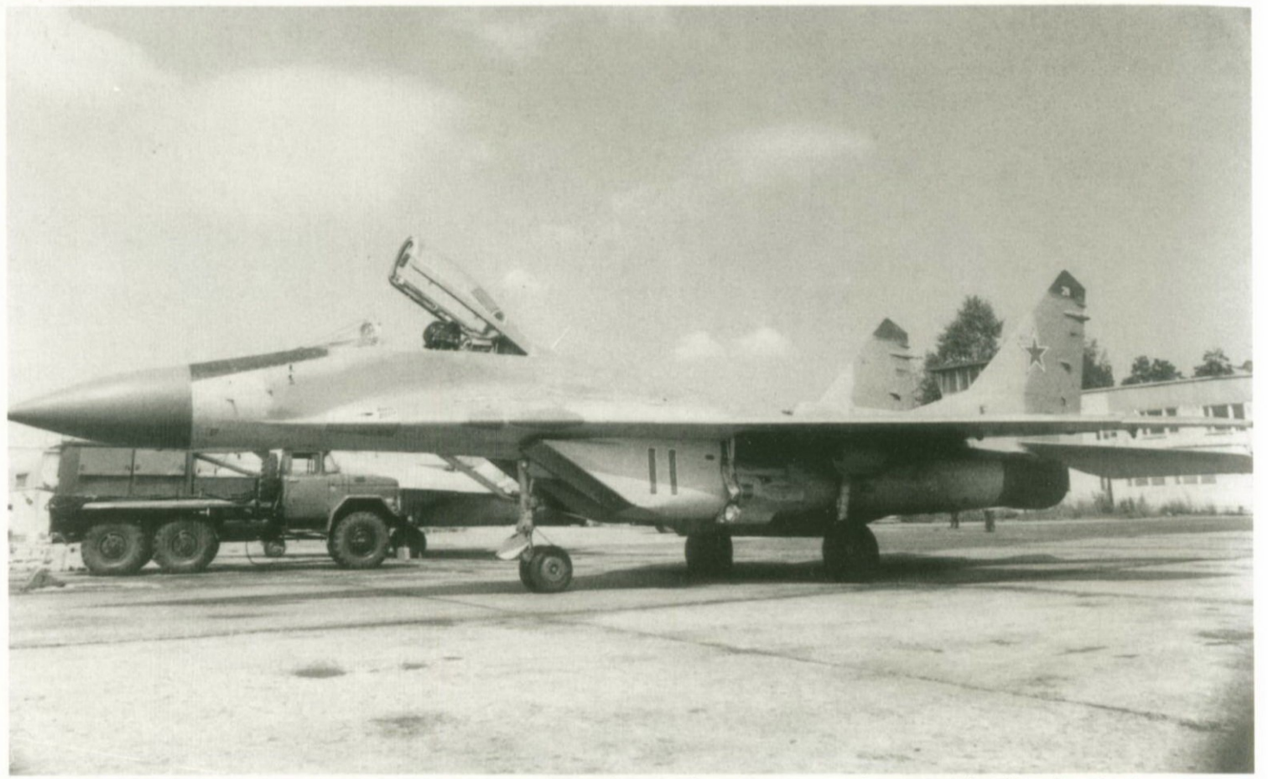
In contrast, the production variants of the MIG-29 had a round cover and smooth fairing at the rear for the parachute housing.

The evolutionary sequence of the MIG-29 family is somewhat confused. At least two distinctively different variants have been identified. This variant has the early style vertical fin without the ASO fairing at the front, a wide chord rudder and a ventral fin. (Hans-Heiri Stapfer)



An early series production MIG-29 from the first Soviet visit to Finland in 1986.

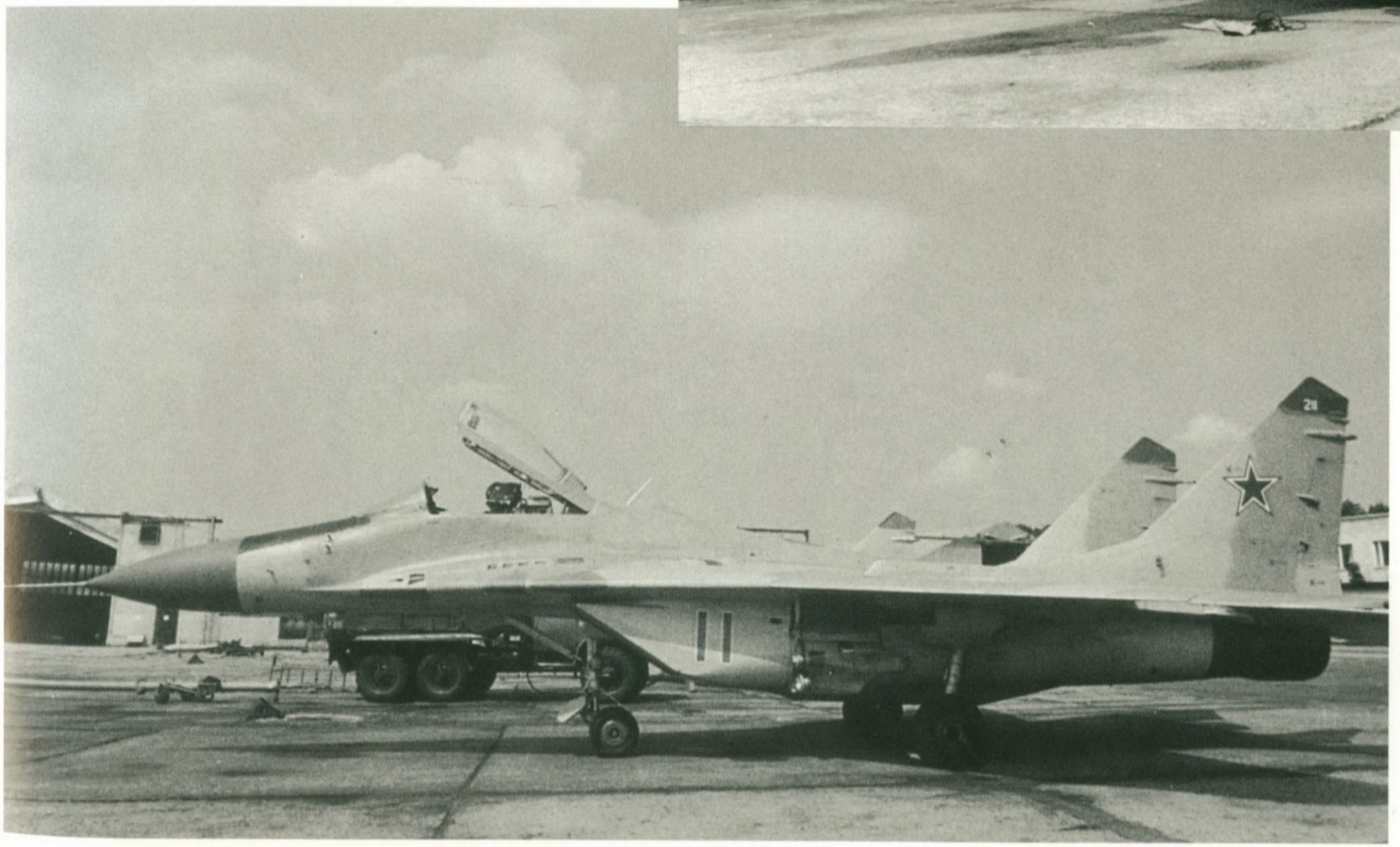
A MIG-29 of the early series in a protective berm at a base in the Soviet Union. Note that the front landing gear has no debris catcher.



This MIG-29 shows the details of the other early production type. Photographed in the Soviet Union in August 1988, it closely resembles the MIG-29 displayed at Farnborough later in 1988. However, there are several distinct differences. The aircraft has a narrow chord rudder, like those of the MIG-29s displayed in Finland in 1986. The front landing gear lacks the distinctive debris catcher, but has a door cover at the front. The canopy has a much heavier internal antenna. Note that the aircraft lacks the vertical fin of the earlier aircraft.

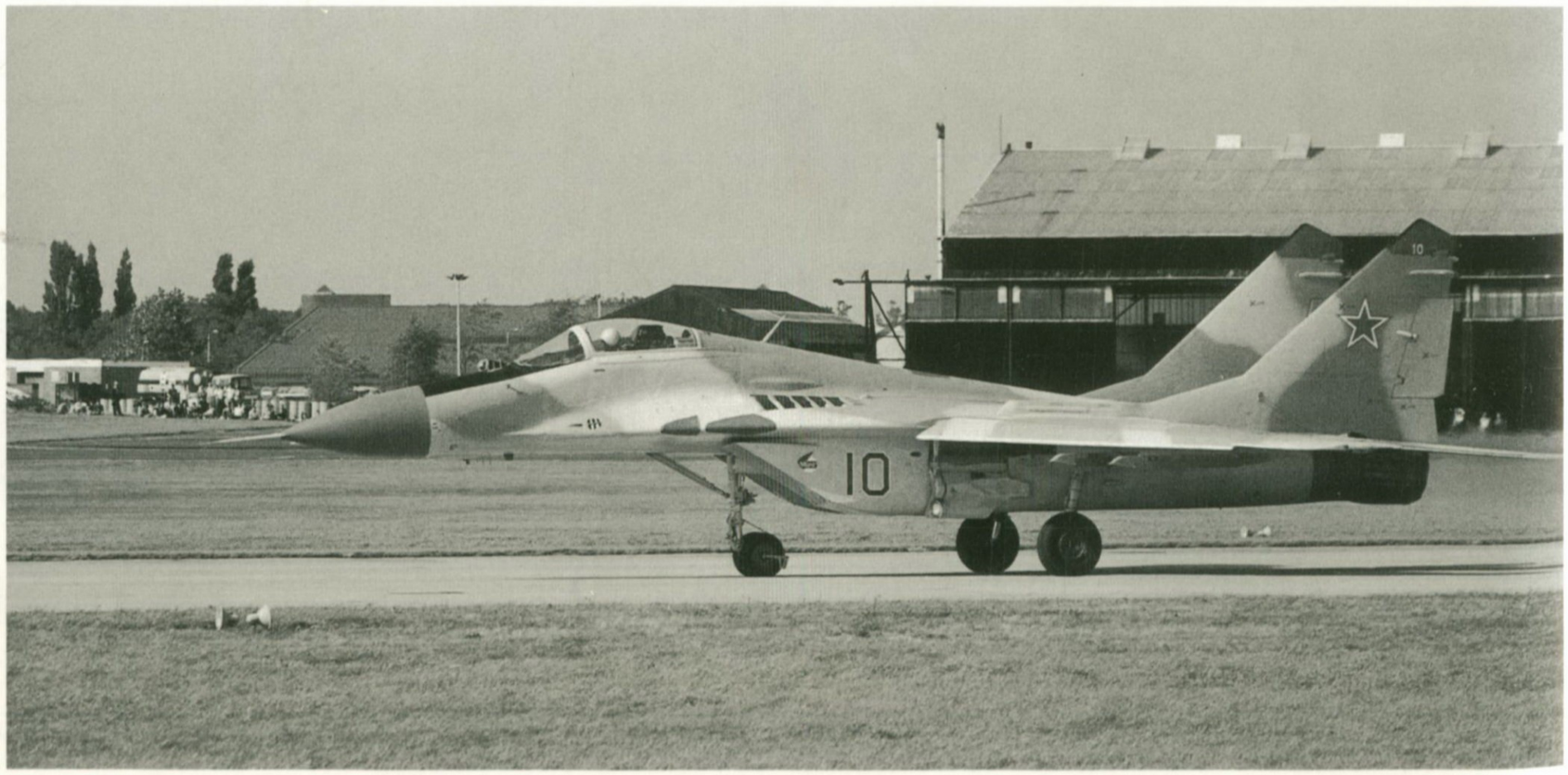
Another view of the early production MIG-29. This view accents two of the differences: the front landing gear door cover and the heavier antenna framing.

This aircraft was used by the Mikoyan demonstration team which flew the MIG-29 at Farnborough. It may represent an experimental type rather than an actual production aircraft. (Sovfoto)



A MIG-29 Fulcrum of a Soviet demonstration unit near Moscow, summer of 1988.

A standard production MIG-29 as displayed at Farnborough in 1988. This machine differed in several small details from the MIG-29s in Finland in 1986. It had a broad chord rudder, like that on the early production machines. The front landing gear was modified by the addition of a debris catcher at the rear. Some export MIG-29 lack the debris catcher, and it is not a definitive feature of this variant.



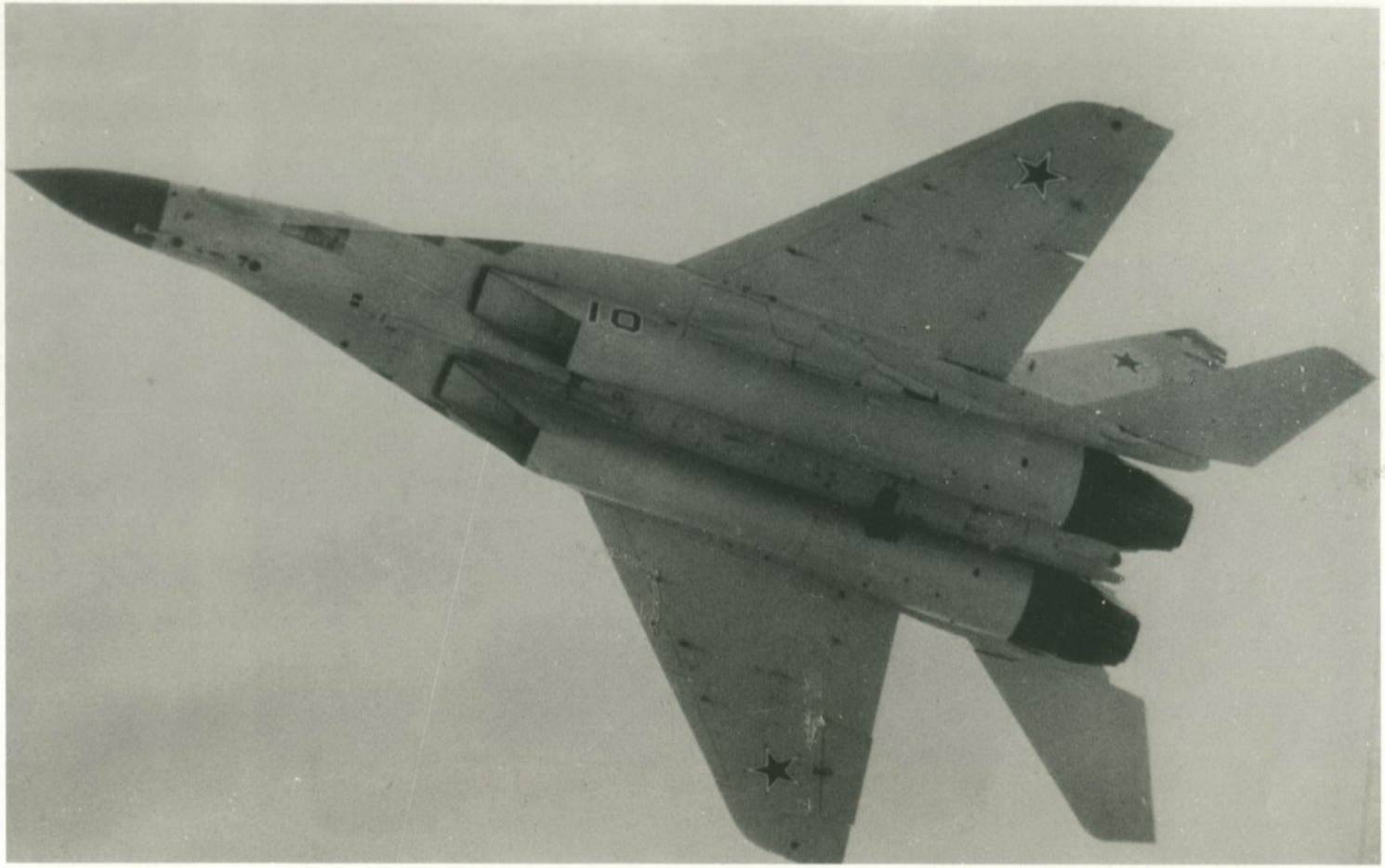
The MIG-29 at Farnborough in September 1988. The aircraft is finished in a two-tone scheme of light grey overall, with a pattern of medium green-grey on the uppersurfaces. The MIG-29 is popularly called the ''Twin Tail'' is Soviet service.

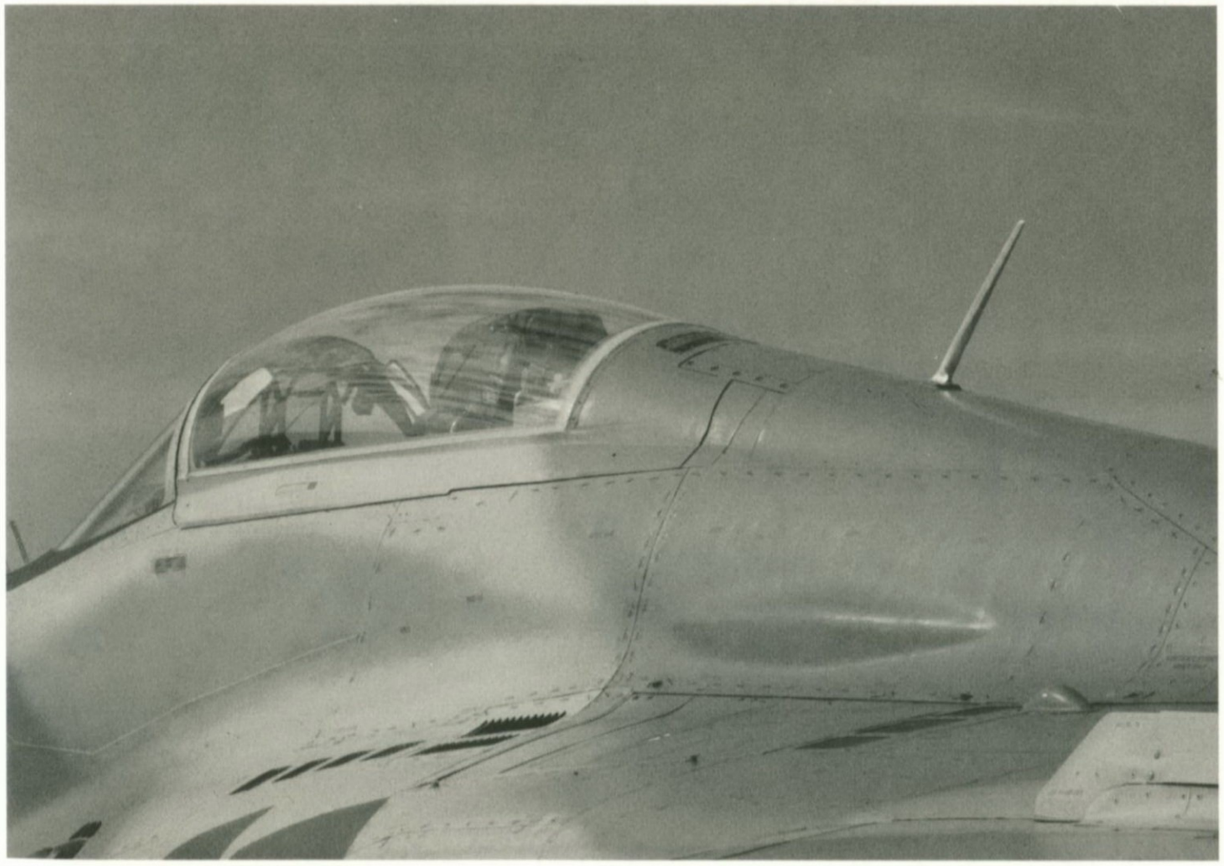
A MIG-29 during take-off at Farnborough, armed with a pair of R-27R missiles and four R-73 missiles. (S. Zaloga)

▶ For its aerial displays, the MIG-29 is often flown clean of weapons pylons and drop tanks. (Hans-Heiri Stapfer)

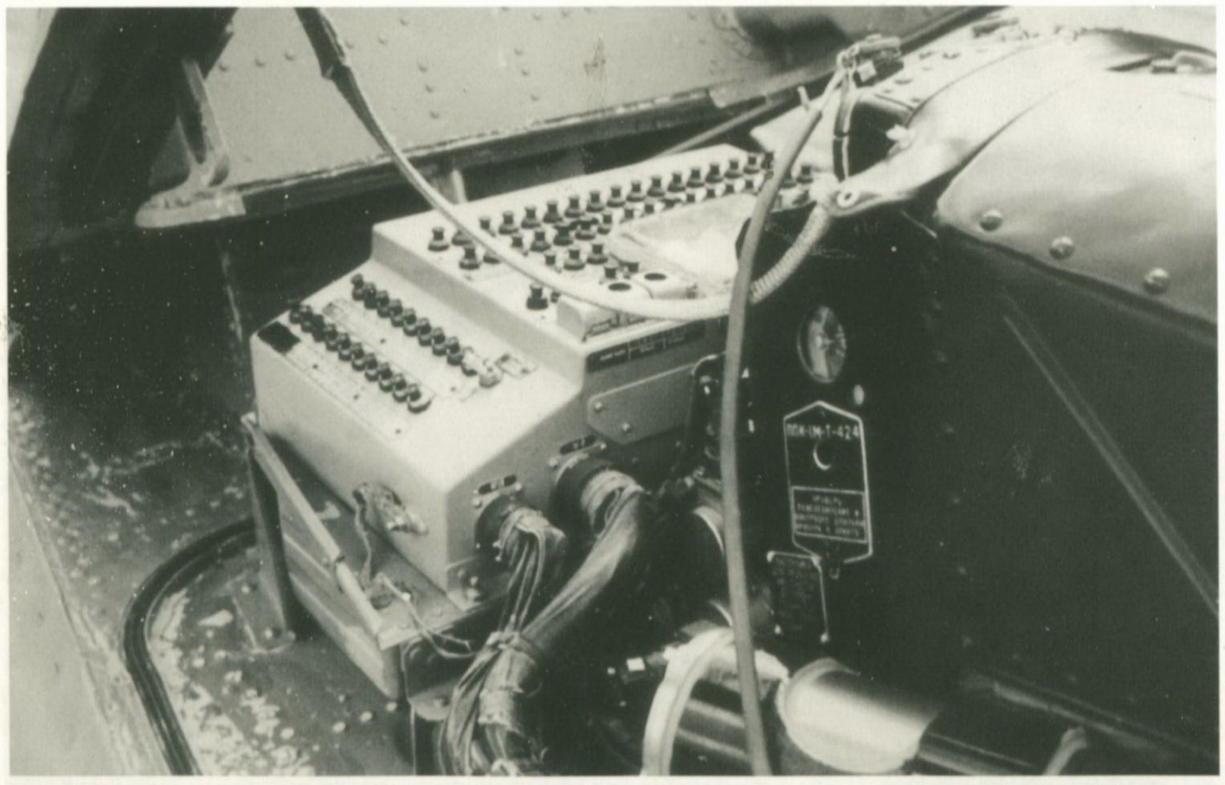
▼ A close-up of the cockpit. The vents evident in the photo are primarily those connected with the GSh-30-1 cannon fitted in the left wing root.

▼▶ The canopy in open position. The headrest of the Severin K-36 ejection seat is very evident in this view.

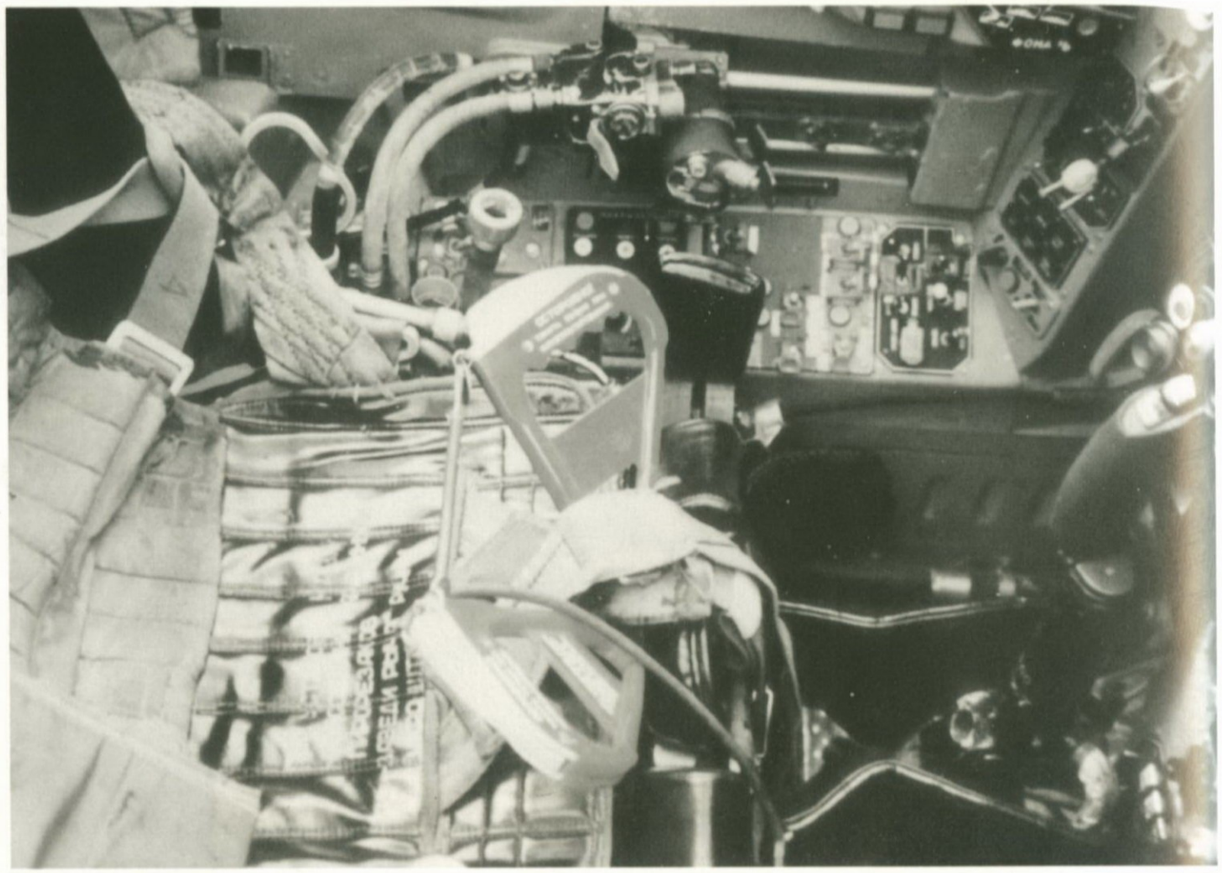




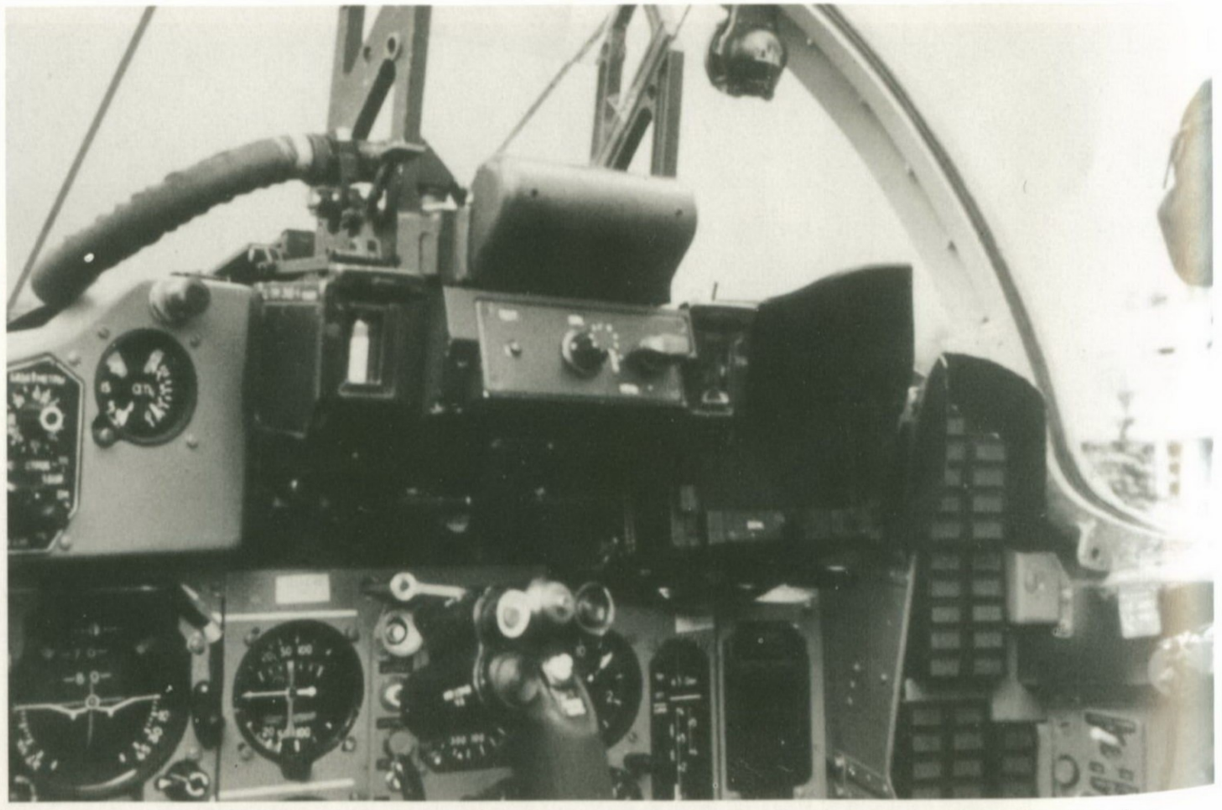
An interior view of the MIG-29 cockpit. Although American and Canadian pilots were very impressed by the aerodynamic performance of the MIG-29, they feel that the cockpit layout of the MIG-29 is outdated, and little advanced over 1960's technology. The small hooded display to the right is the radar display; however, if the RP-29 Slot Back follows earlier Soviet practice, some radar imagery is available through the HUD as well. (US Air Force)



A view behind the seat at the large circuit-breaker panel. (US Air Force)



A view of the left console controls and seat. The red handles in the center of the picture are for the Severin K-36 ejection seat. (US Air Force)



A view of the instrument panel of the MIG-29. In the upper center is the Heads-Up Display for the aircraft. At the extreme right is a panel of warning lights. (US Air Force)

The latest version of the MIG-29 family is the MIG-29M Fulcrum C, which has a noticeably chunkier appearance than the two earlier models of the family, the MIG-29 (9.12) and MIG-29 (9.13). (Sovfoto)

A closeup of the canopy area of a Soviet MIG-29 with an operational unit in the summer of 1988. The pilot is wearing the standard Zsh-7A helmet. This is an early production machine as is evident by the old-style rear-view mirrors on the canopy frame. (Sovfoto)

The MIG-29 at Farnborough with its braking parachute deployed. (S. Zaloga)

A side view of the left side landing gear. The gear well is painted in the same pale grey finish as the undersurface. The wheel hub is a dark green, typical of nearly all Soviet aircraft.

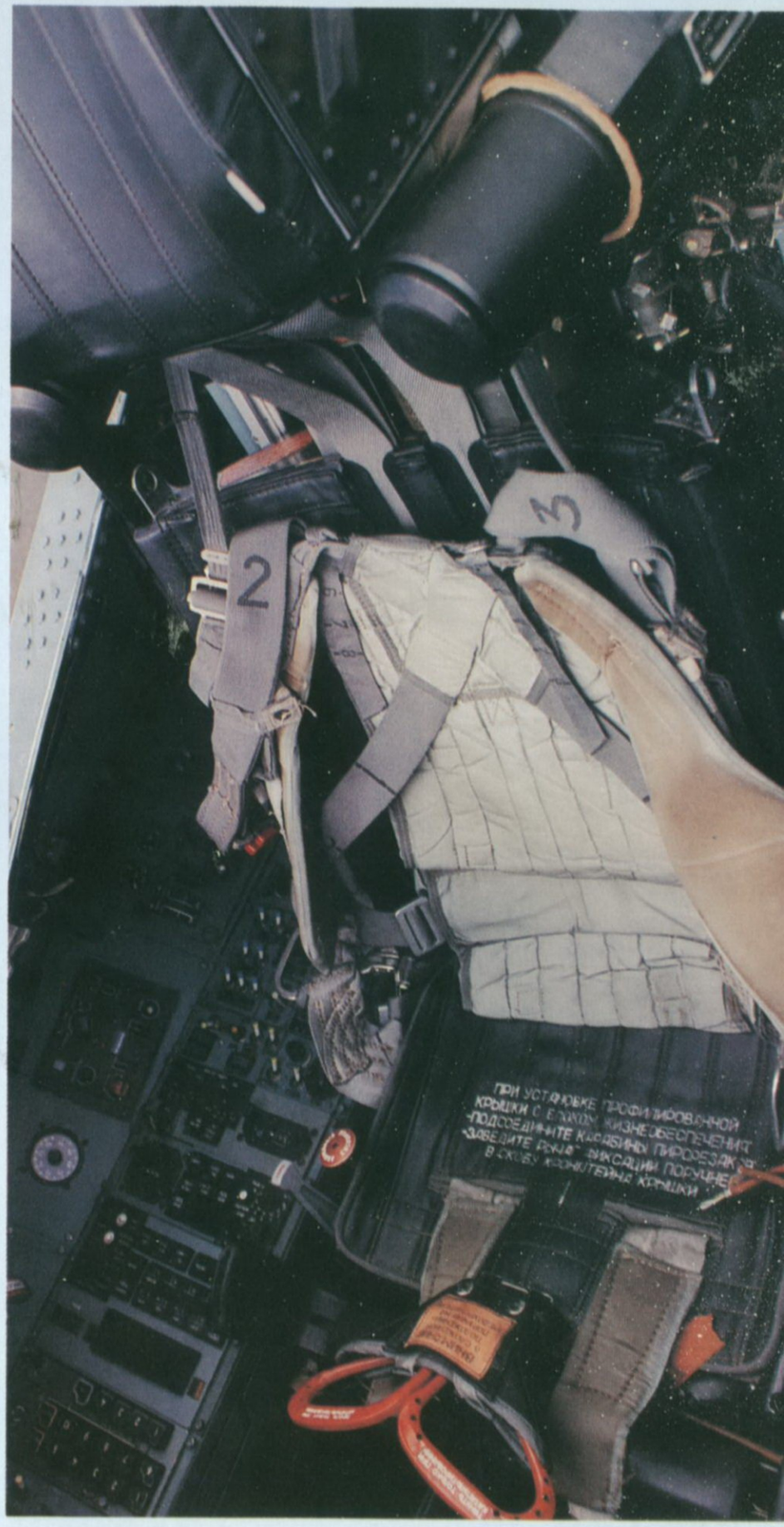
A forward view of the nose landing gear. The air intakes are fitted with a special panel which seals them off during take-off to prevent the ingestion of debris. At the same time, a series of panel over the wing root open up to draw in air at the same time.

A close-up of the canopy of the MIG-29UB. The hump at the top of the canopy is a periscopic sight to give the instructor (in the rear seat) a clear view of the runway over the head of the student pilot.

By the time of the 1989 Paris Air Salon at Le Bourget airfield, Soviet security had relaxed and the engines were more openly displayed. Here is a closer view of the tail pipes of the MIG-29UB trainer.

The cockpit interior of the Su-27 fighter. The basic color of the cockpit is a medium bluish-grey with many of the controls in black. (S. Zaloga)

A view of the rear cockpit in the Su-27UB trainer. The instrument layout is considerably different than the front seat arrangement which is like that in the normal fighter. (S. Zaloga)



A close-up of the Severin K-36DM Series 2 ejection seat in the Su-27. This is the same ejection seat fitted to the MIG-29. (S. Zaloga)

A head-on shot of a Czechoslovak MIG-29 at Zatek. (Yves Debay)

A Czechoslovak MIG-29UB trainer of the 11th Fighter Regiment takes off from its base at Zatek in Bohemia. Note that the instructors vision periscope is in the raised position, a feature not commonly seen. (Yves Debay)

The Czechoslovak MIG-29UB trainers are finished in a dark color scheme including brown and green. This same scheme is also seen on Soviet two-seat trainers. (Yves Debay)

◀ An interesting view of a Su-27 Flanker landing. The Su-27 dielectric panels of the tail and the radar nose cone vary in color. Initial aircraft in service had all these surfaces finished in a dark black green. The aircraft at the Le Bourget and Farnborough air shows had the surfaces finished in white. This aircraft is a combination of both white nosecone and black-green tail dielectric panels. (Sovfoto).

◀▼ A squadron of MIG-29 which visited Finland in July 1988.

▼ Su-27 coming in for a landing with its airbrake extended. (S. Zaloga)

A right side view of the cockpit canopy in the open position. Much of the interior of the canopy frame is finished in a pale grey-green color.

A detail view of the thermal imaging sensor in the IRST.

A close-up of the intake of the Su-27. The Su-27 has a system to prevent the foreign object ingestion damage (FOD) during take-off, including a series of panels in the air intake, barely evident in this view.

A Su-27UB trainer being towed out to the flight-line.

A close-up detail shot of the Su-27UB showing the elongated canopy as well as the blast panels around the GSh-30-1 cannon.

▲▶ The first forward deployed Su-27 regiment was sent to Poland in 1989. In this role, it will escort strikes by Su-24 bombers. This aircraft is seen in its fully armed configuration with R-27 and R-73 missiles, including the rarely-seen use of the wing-tip pylon. The missiles are fitted with their red safety covers which are removed before flight. The marking on the tail is the older pattern Sukhoi bureau insignia.

▲ A shot below the decks of the new Soviet aircraft carrier Admiral Kuznetsov, showing the new Su-27K naval fighter. Resembling the normal Su-27, the Su-27K has folding wings and other navalized features. A similar MIG-29 version, the MIG-29K, has also been tested. (Sovfoto)

▶ A Su-27K on the deck of the Admiral Kuznetsov during flight trials in 1990. An experimental version of the Su-27, the Type 10-24 with canard wings, was also tested on the carrier. (Sovfoto)

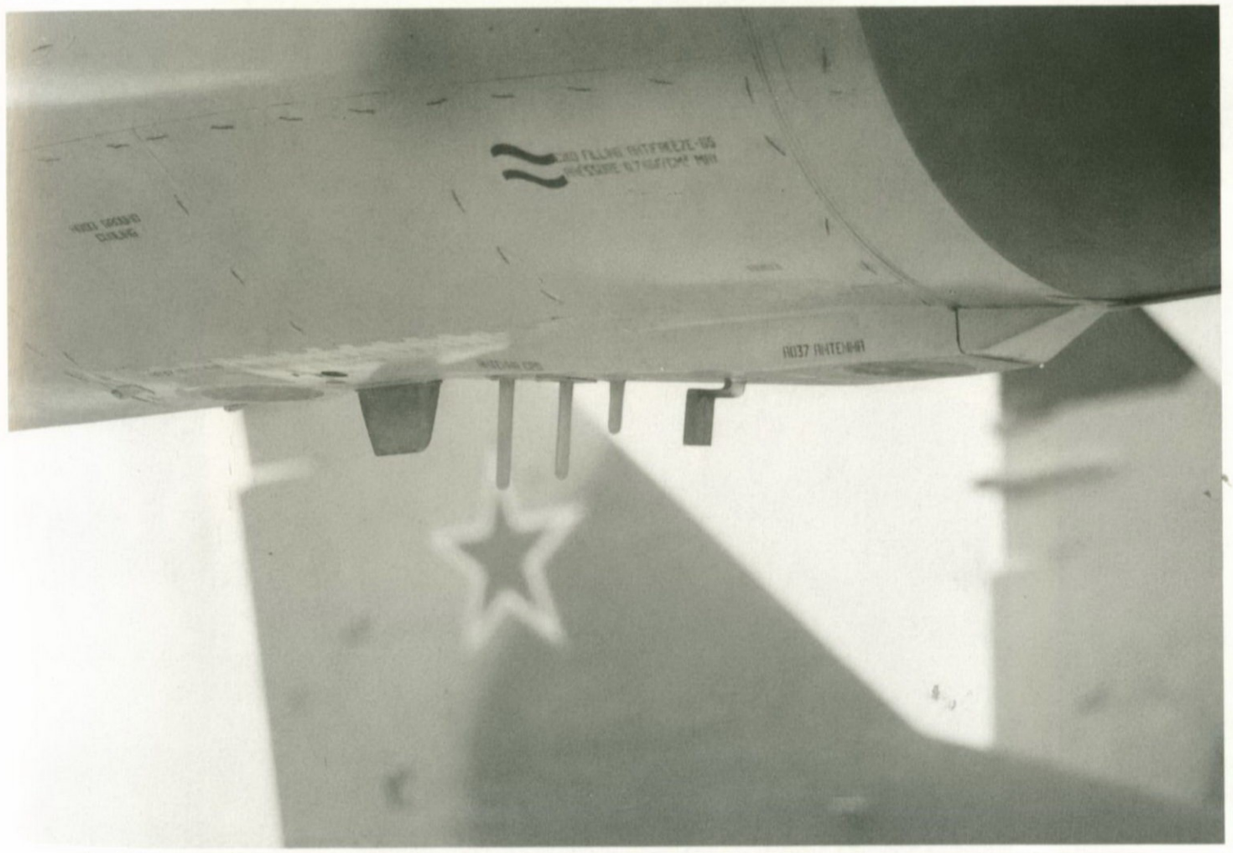
A right side view of the Khodynka MIG-21bis. The inner missile pylon on this aircraft is not the common APU-13M type, and may permit the use of more recent missiles types such as the R-73 (AA-11 Archer). (Nick Cook)

A rear view of the MIG-25RB reconnaissance variant. These aircraft are finished in an overall pale grey finish, with most of the dielectric antennas left in bare dark grey plastic color. (Nick Cook)

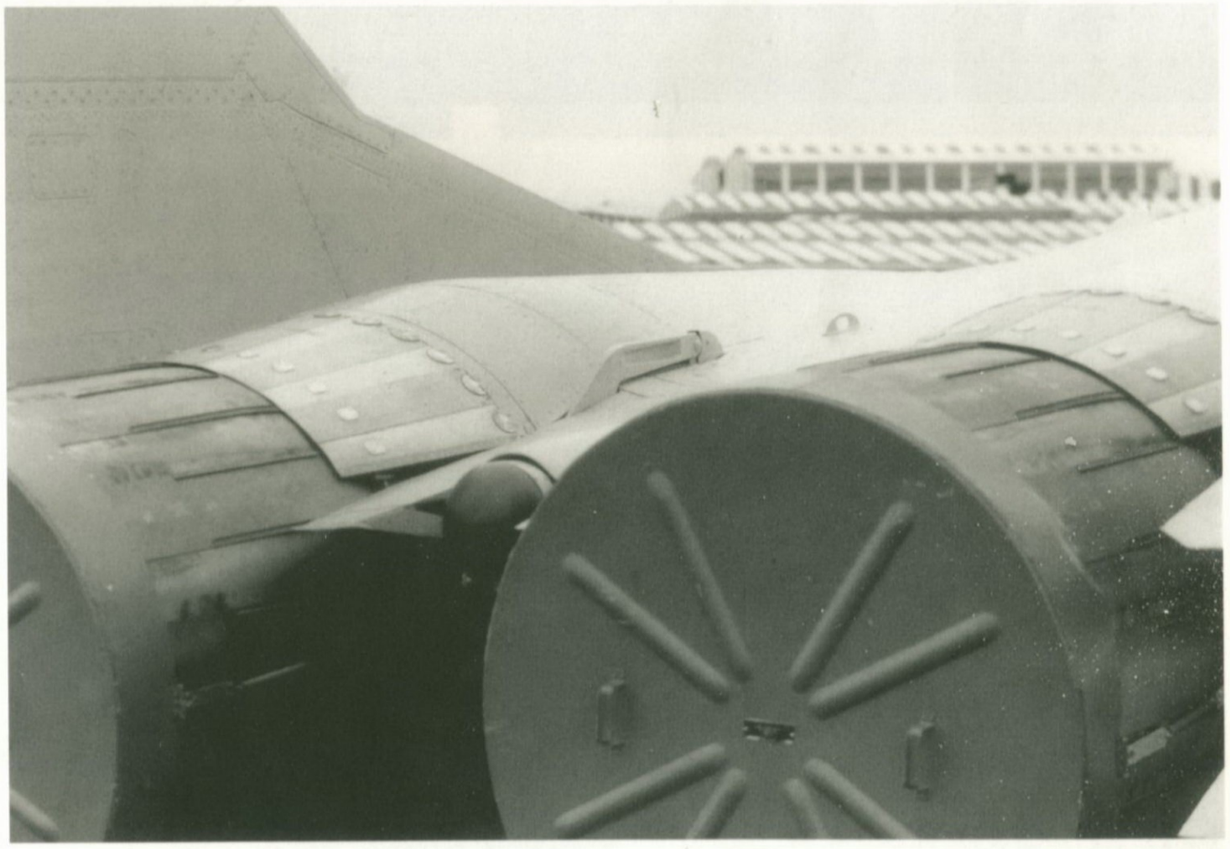
An F-15 Eagle escorts an Su-27 flown by Viktor Pugachev during a visit to the United States in the summer of 1990. (USAF)

One of the interesting differences between contemporary Soviet fighters and those manufactured in the US and Europe is the provision for a supplementary infrared sight. The Sh-1 sight found on the MIG-29 is mounted on the right front corner of the canopy area. This allows the pilot to track an enemy aircraft without giving his presence away by the use of radar.

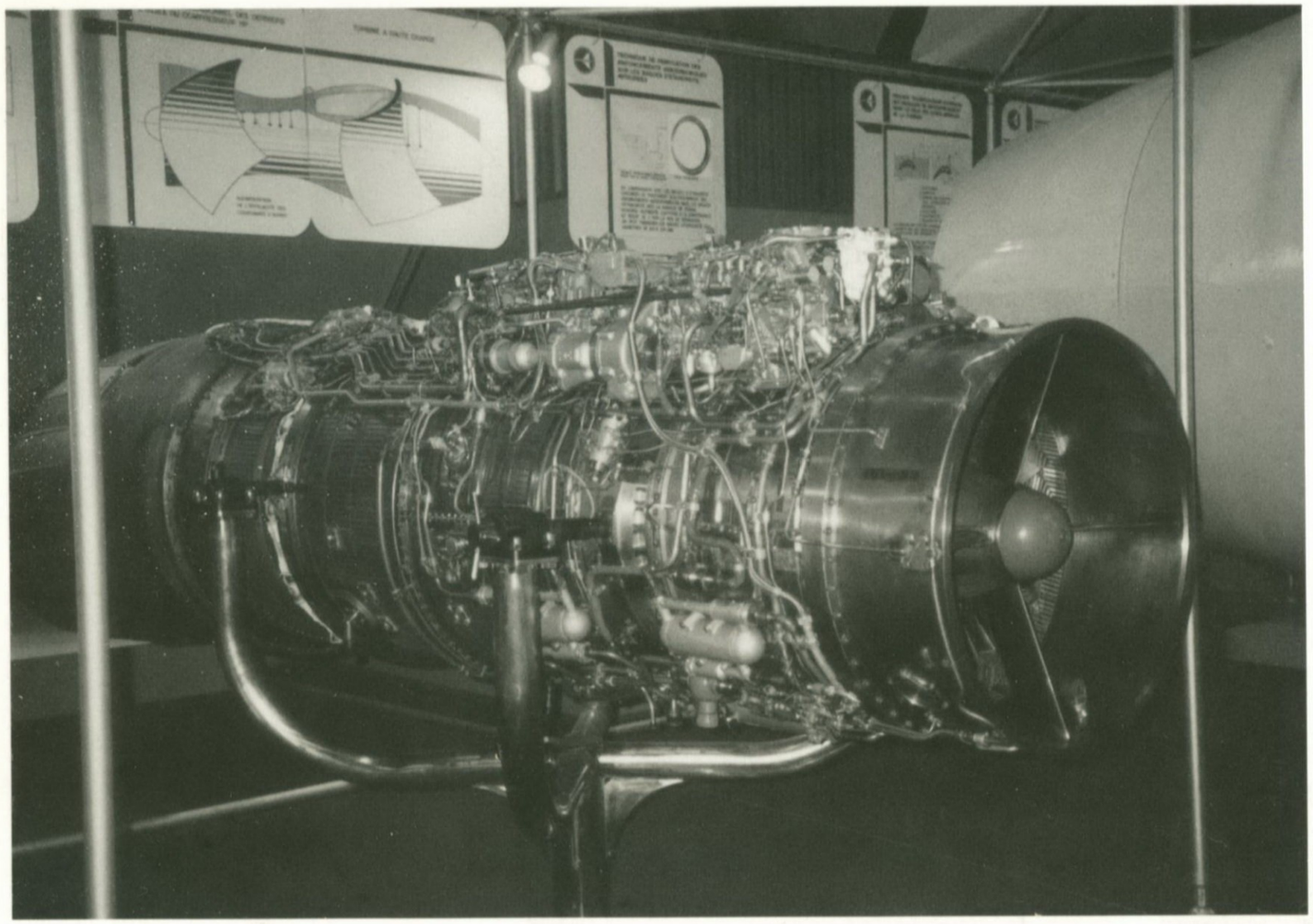
A close-up of the thermal sensor in the Sh-1 infrared sight. Some older American interceptors carried such sights, such as the F-101 Voodoo, but they have been abandoned in designs of the 1960's and 1970's due to shortcomings with the sights at lower altitudes where weather conditions can interfere.



A close-up of the sensor package under the nose of the MIG-29. These consist of an orange dielectric panel for the radar altimeter, a sensor vane for the attitude control system, the three blade SRO "Odd Rods" antenna for the Khrom Nikel identification-friend-or-foe (IFF) system, and a communications antenna.



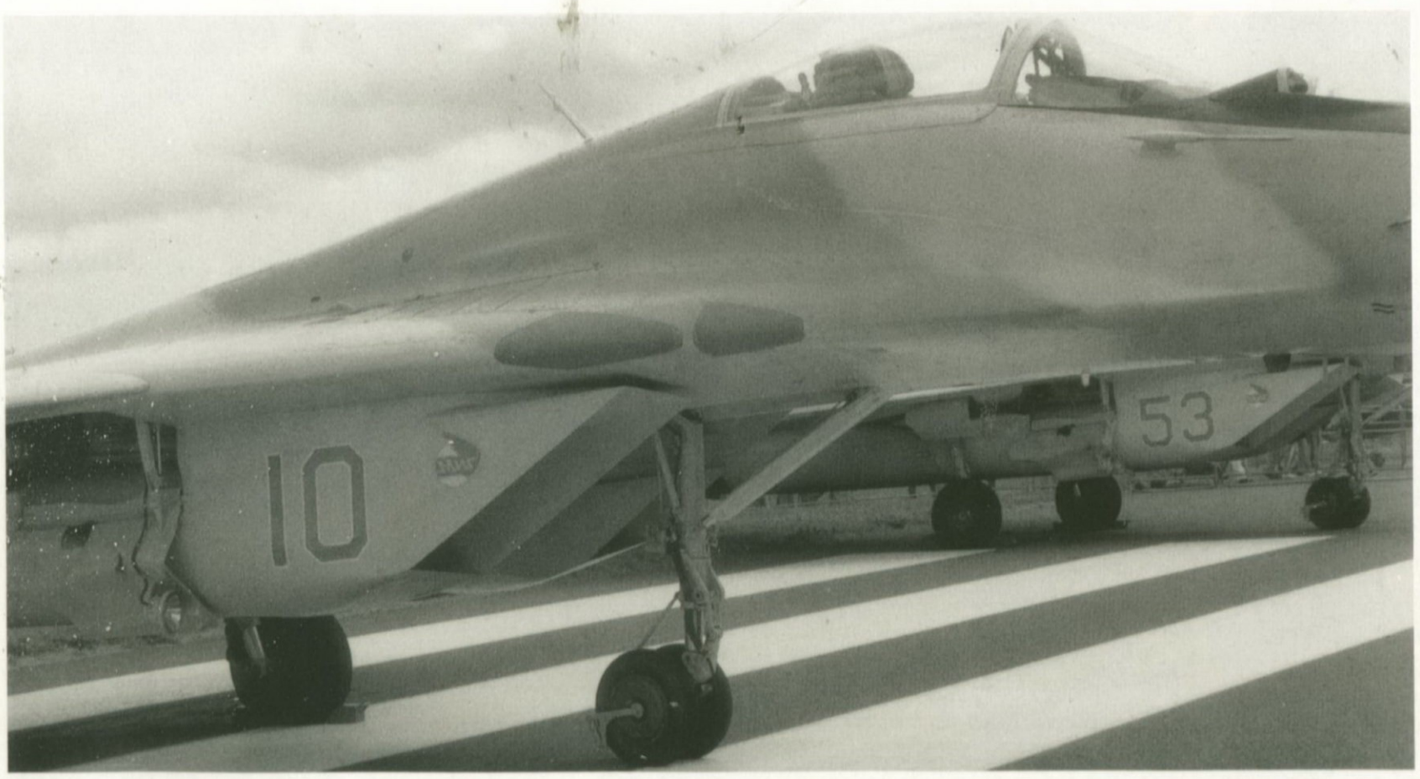
A view of the rear of the MIG-29 showing the "turkey feathers" of the tail pipes. Between the two jet engines is a domed cover for the braking parachute.



◀ Not only were the tailpipes displayed, but the entire engine. The RD-33 provides 8300 kg per sec. of thrust. It was developed by the Klimov Design Bureau, recently renamed the Leningrad Design Bureau.

◀▼ A view of the forward corner of the right wing root. The two grey dielectric panels are antennas for the aircraft's electronic warning system. The insignia in front of the aircraft ''bort'' number is the MIG Design bureau insignia.

▼ The front landing gear on some export MIG-29s are not fitted with the debris catcher. This is the forward landing gear of an Iraqi MIG-29. (C.Foss)

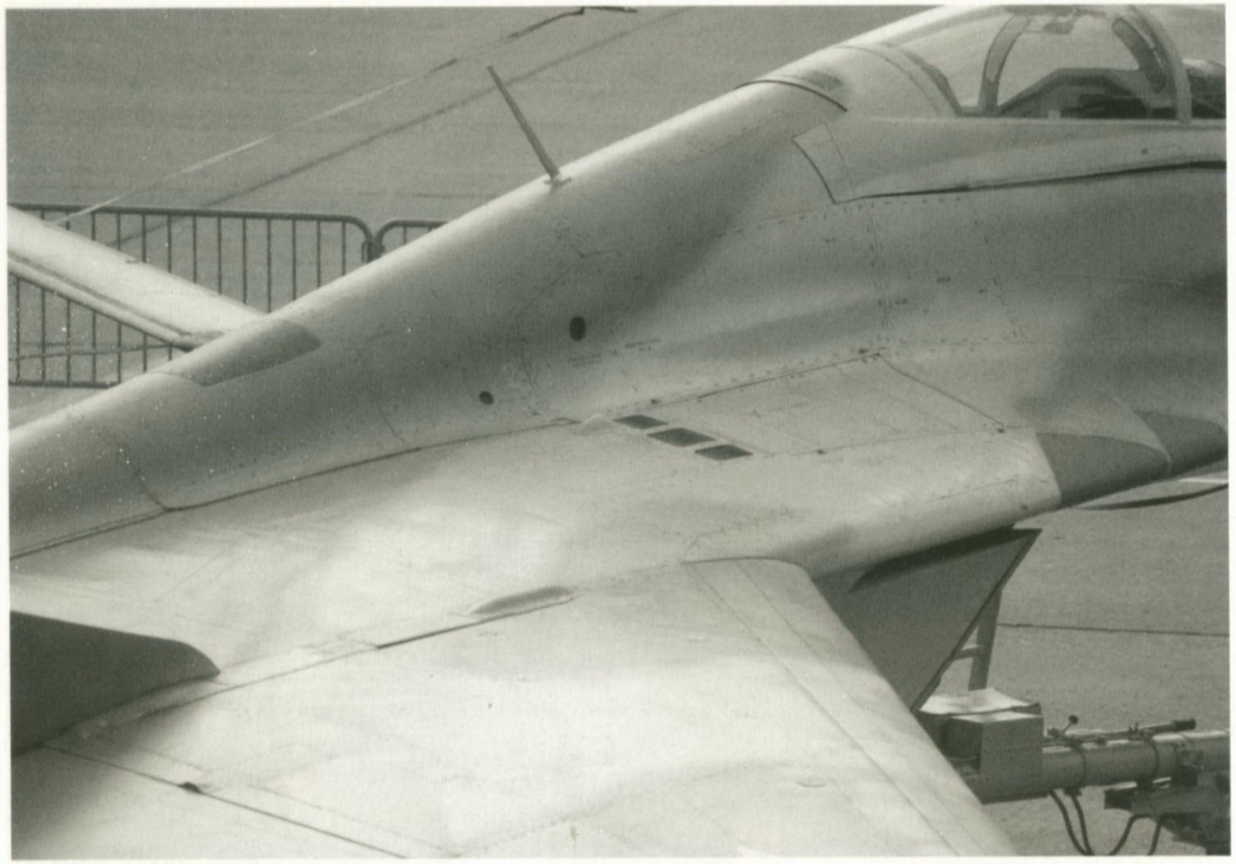


▲ The nose landing gear of the Farnborough MIG-29. The standard production aircraft are often, though not always, fitted with this distinctive debris catcher.

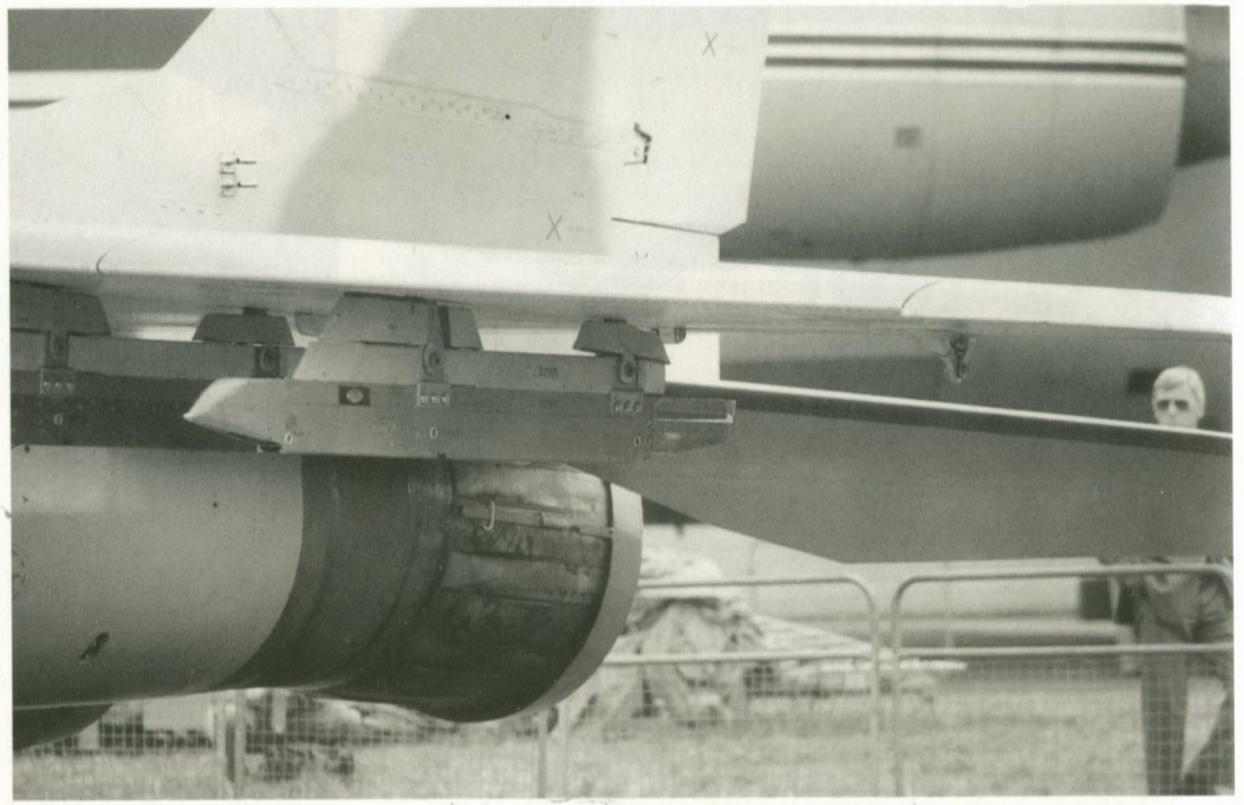
▶ A view of the nose landing gear from the rear.

▲▲A head-on view of the landing gear of the MIG-29, showing the landing light.

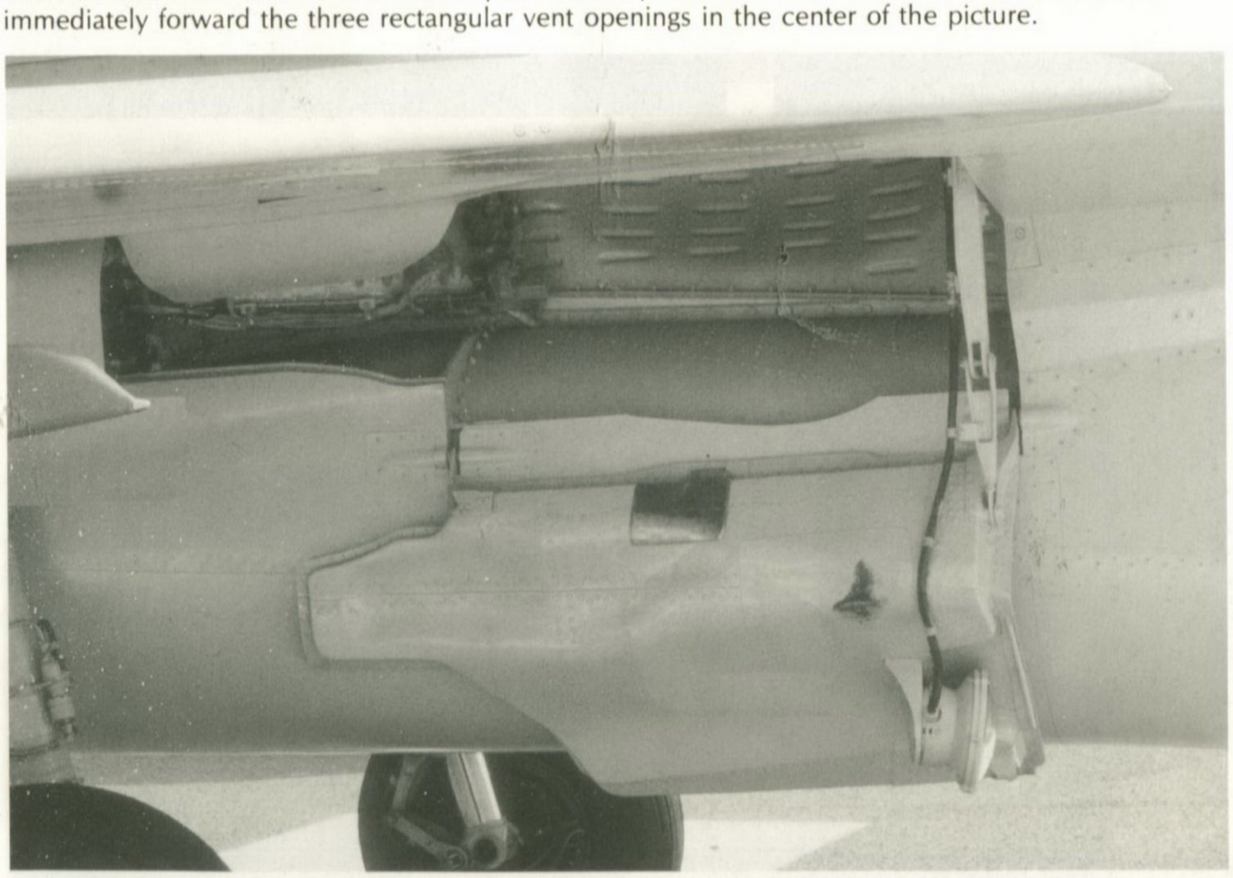
▲▶The right landing gear, looking up into the wheel-well. (C.Foss)



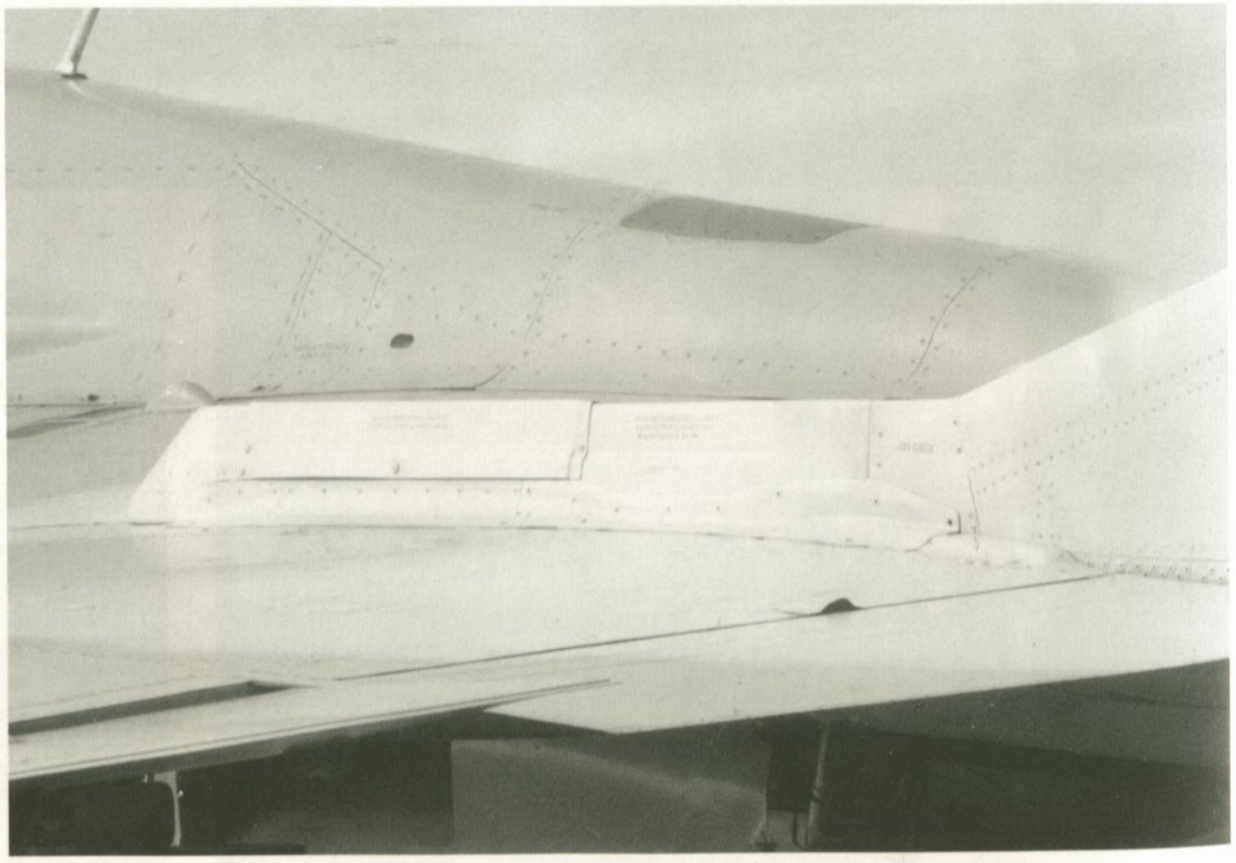
When the main air intake is open, the wing root intakes are closed shut as in this view. These five vent doors are hard to see on this photo as they are almost flush to the surface. They are immediately forward the three rectangular vent openings in the center of the picture.



This is the standard pylon for the R-60MK missile carried on the outer stations of the MIG-29.



A close-up view of the wheel-well on the right side of the aircraft.



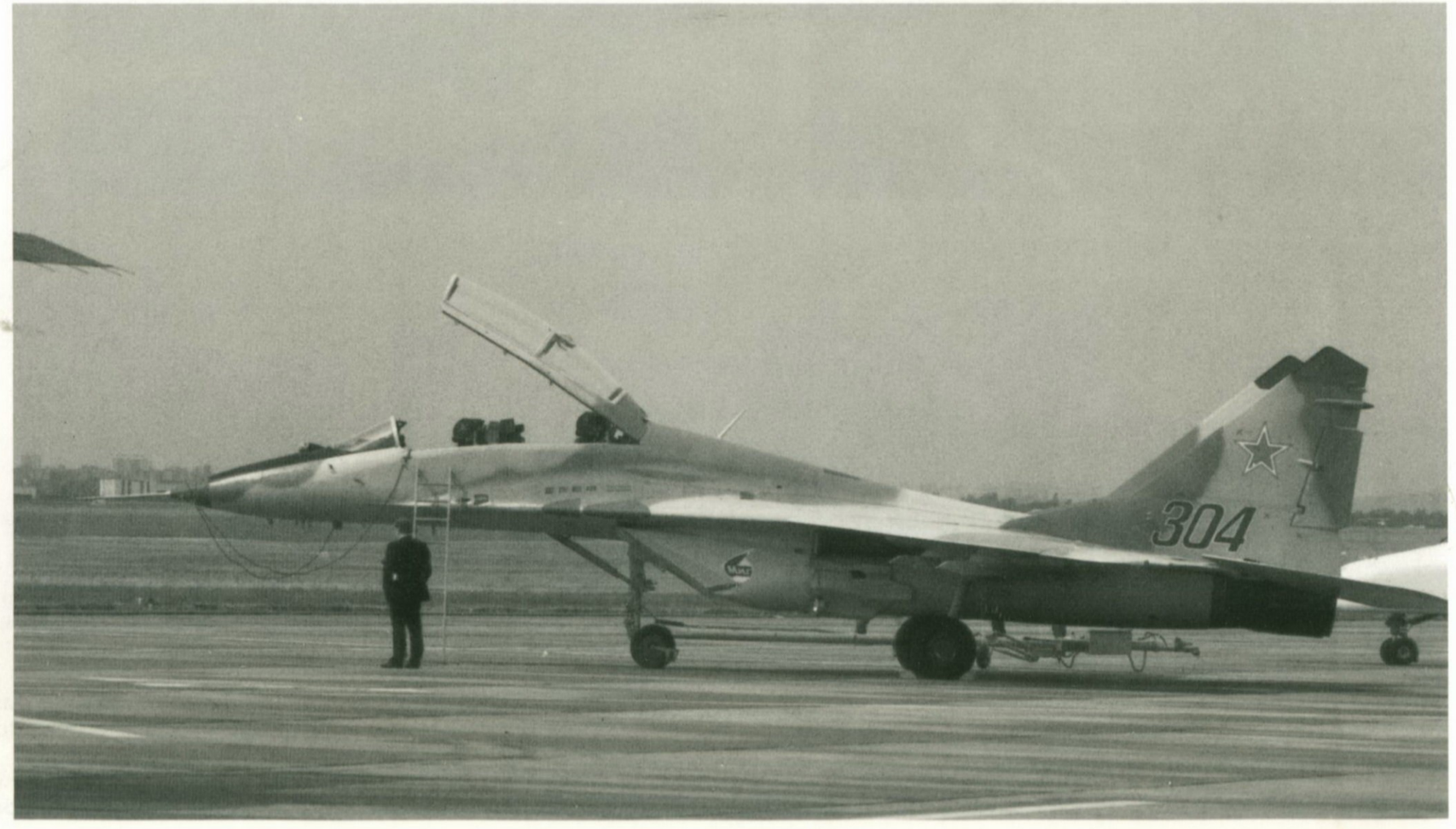
The MIG-29s displayed in Finland, Farnborough and Le Bourget were fitted with these ASO flare countermeasure dispensers at the leading edge of the vertical tails. These dispensers are activated to decoy infrared-guided missiles away from the fighter.

◀▲ A close-up of the early pattern tail on the MIG-29 showing the short leading edge. Note also the broad-chord rudder.

▲ Although the MIG-29s displayed in Finland in 1986 had narrow-chord rudders, with the trailing edge of the rudder flush with the rest of the tail, on the MIG-29s seen at Farnborough in 1988, these broader-chord tails were present.

▶▲ A view of the left tail of the MIG-29UB at Farnborough. The fairing above the rudder is a rear-ward pointing electronic warning antenna which searches for signals from enemy fighter radars.

◀ The MIG-29UB is a two seat trainer version of the MIG-29. It is not fitted with the usual RP-29 Slot Back air search radar found in the usual fighter version.

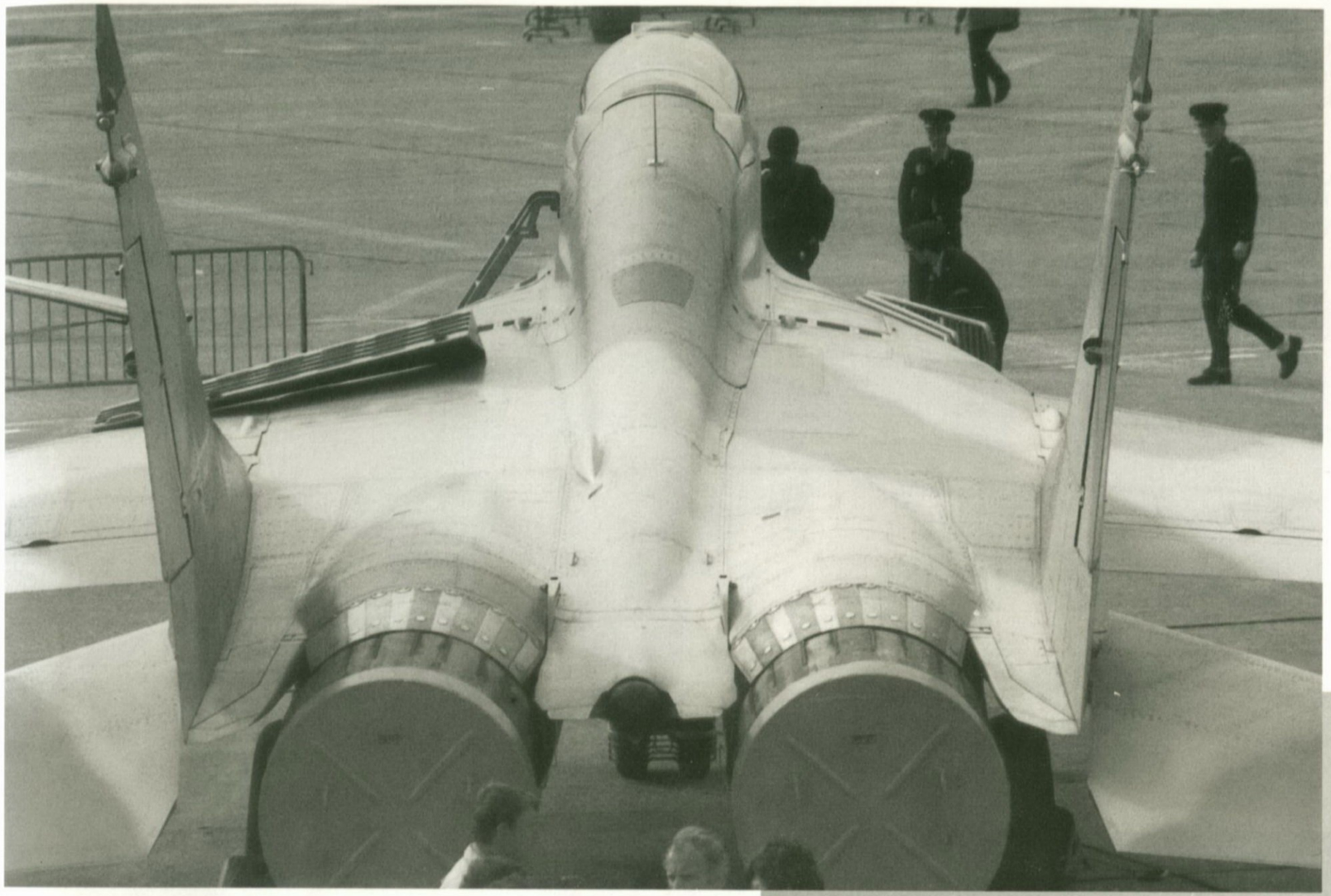


▲ Another view of the MIG-29UB at Farnborough. The MIG-29UB is combat capable, and can carry both missile and gun armament. However, the absence of the RP-29 radar, also known by its industrial designation NO-193, means that it cannot guide the R-27 (AA-10 Alamo) missile.

▲ ▶ This profile view of the MIG-29UB shows how the second aircrew station was added- by pushing the crew compartment forward into the area formerly occupied by the aircraft radar.

▶ A MIG-29UB trainer exhibited at Le Bourget in 1989. The aircraft carried a tail number, not found on aircraft in actual Air Force service.

A view over the tail of the MIG-29UB trainer.

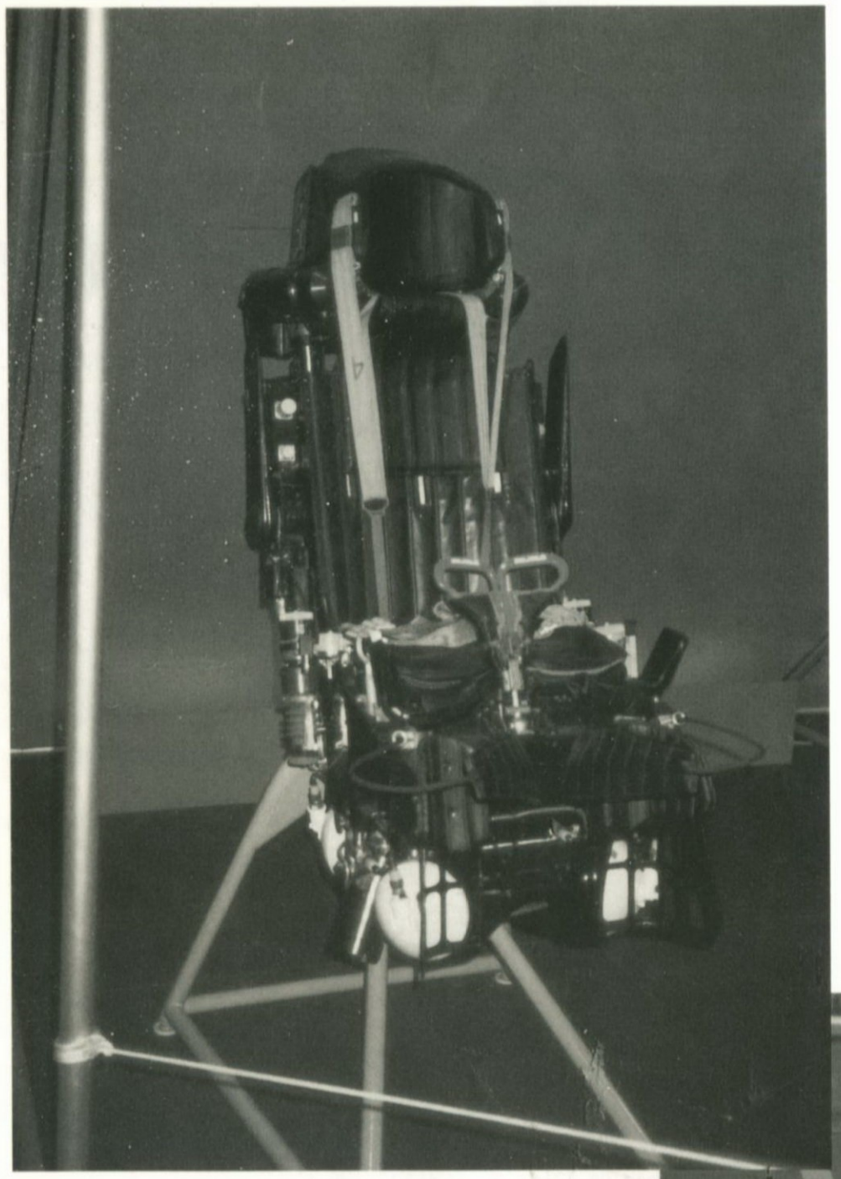


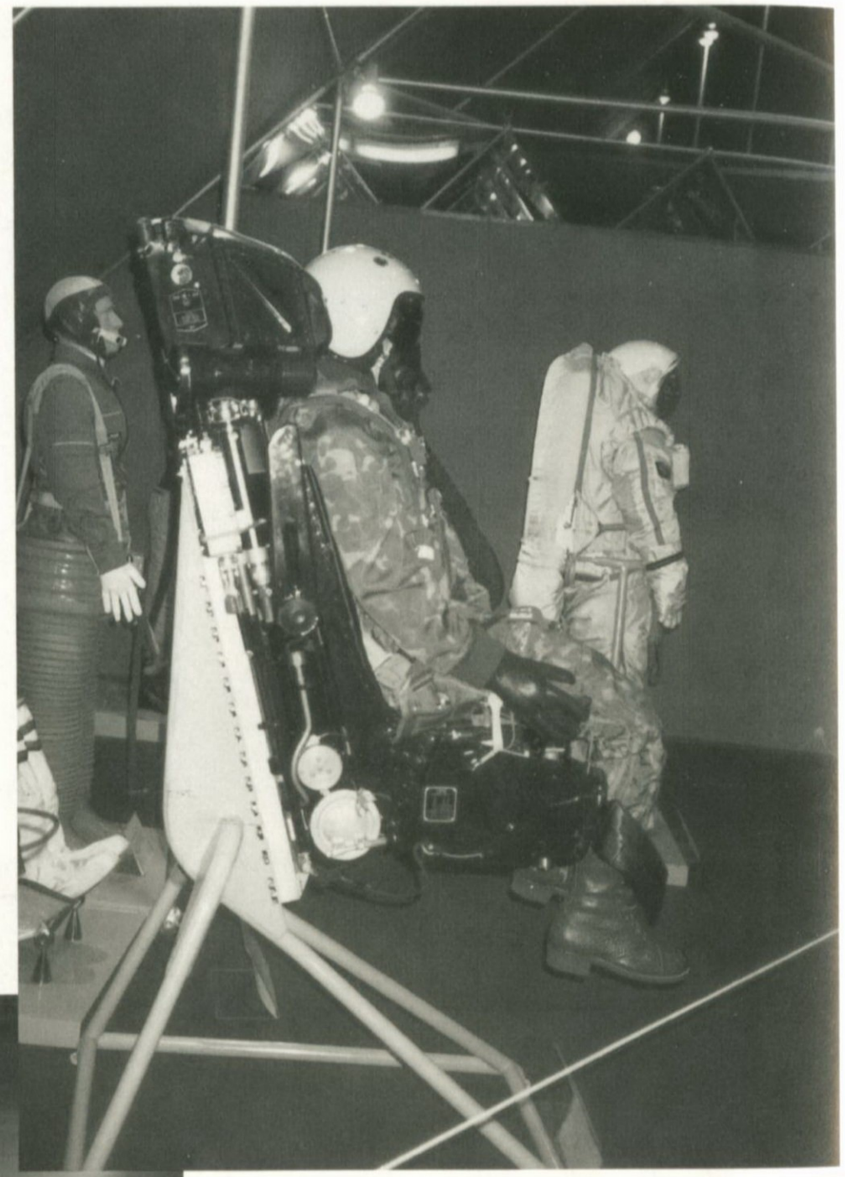
The MIG-29UB trainer does not usually carry the ASO flare dispensers found on the fighter variants.

◀ A detail view of the Severin K-36 ejection seat. This type of seat is used in most contemporary Soviet single-seat aircraft including the MIG-29, Su-27 and Su-25. The seat is black overall with pale orange harness straps and red ejection handles.

▶ A side view of the K-36 ejection seat with a mannikin in place. The mannikin is in a camouflage coverall first introduced in the late 1980s in Afghanistan. It is not commonly seen in use during peacetime.

▼ A pair of MIG-29 drop tanks. These are the type carried on the wing pylons. The underbelly tank has no fins and has a different shape.





◀▲ The Iraqi Air Force was one of the first services outside the Warsaw Pact to receive the MIG-29. This aircraft, numbered 39060 in black on the air intake, was photographed outside Baghdad in 1989. (C.Foss)

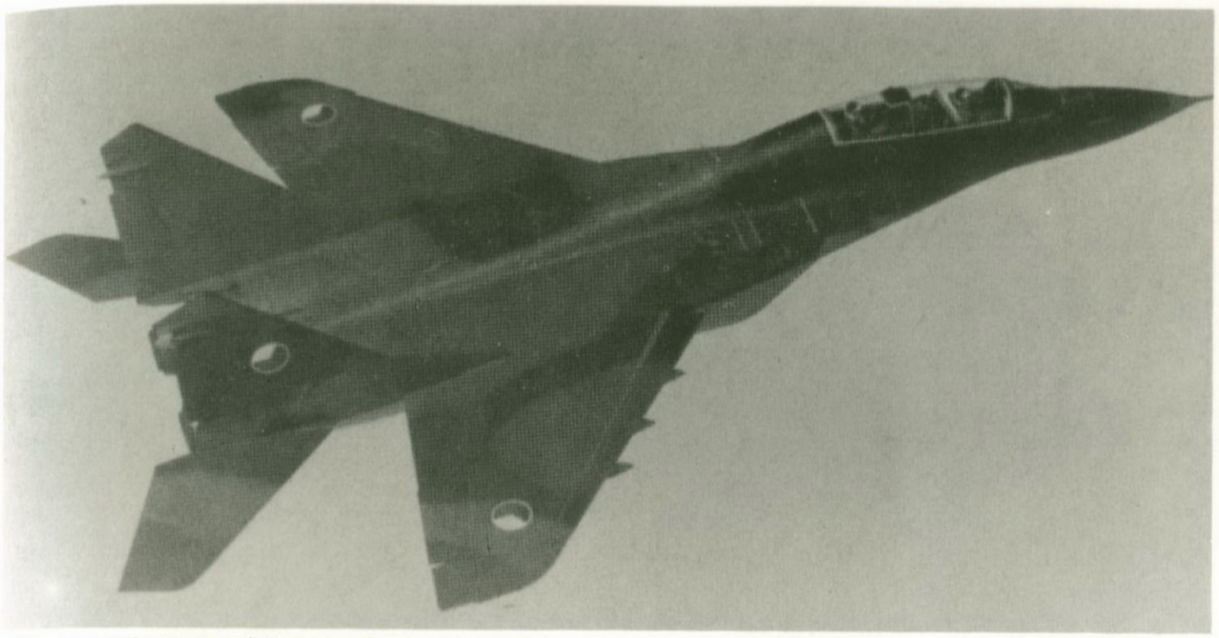
◀ A rear view of Iraqi MIG-29. The national insignia is carried on the vertical tail, the triangular Air Force version near the root, and the national flag in the usual position. (C.Foss)

▲ An Iraqi MIG-29 taxiing for take-off. These aircraft are finished in the same grey/grey-green scheme seen on the MIG-29s at Farnborough and Le Bourget. (C.Foss)

The Polish Air Force began operating MIG-29s in 1989. They were first deployed with the 1st Warsaw Fighter Regiment at Minsk Mazowiecki. The regiment uses the Warsaw city emblem, the armed siren, as its unit insignia, in yellow with blue waves and wings, red shield and white detail.

A squadron of MIG-29 which visited Finland in 1989, with a Finnish MIG-21 in the background. The Finns have considered the purchase of MIG-29 fighters.

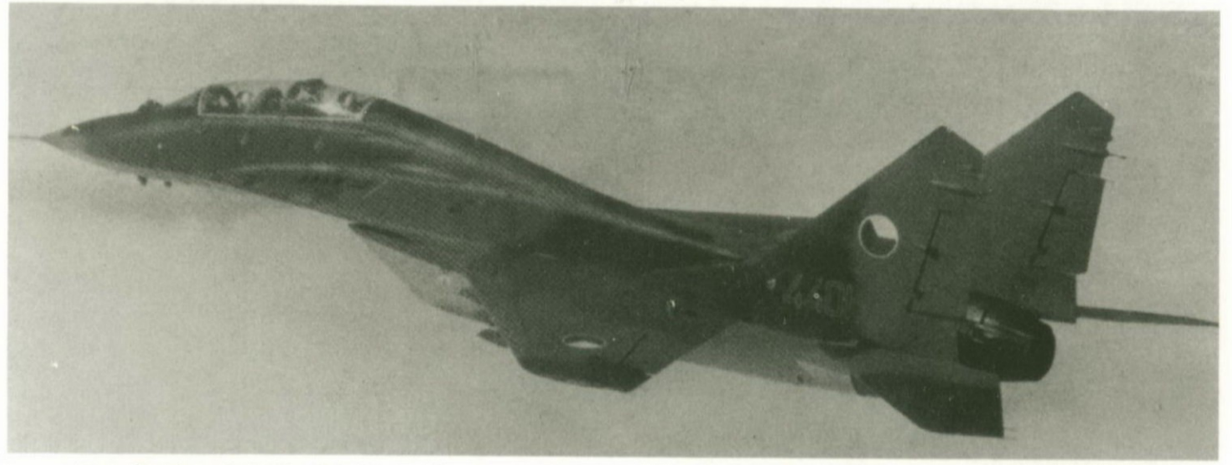
The East German Air Force began operating MIG-29s and MIG-29 UBs in 1989. They are in the standard two-tone grey/grey-green scheme, and some are in a dark camouflage pattern as seen on the Czechoslovak aircraft. This MIG-29UB is the standard scheme. (Hans-Heiri Stapfer)



A MIG-29UB of the Czechoslovak Air Force. The CSLA aircraft are in a darker camouflage scheme of dark and medium green with small patches of tan.

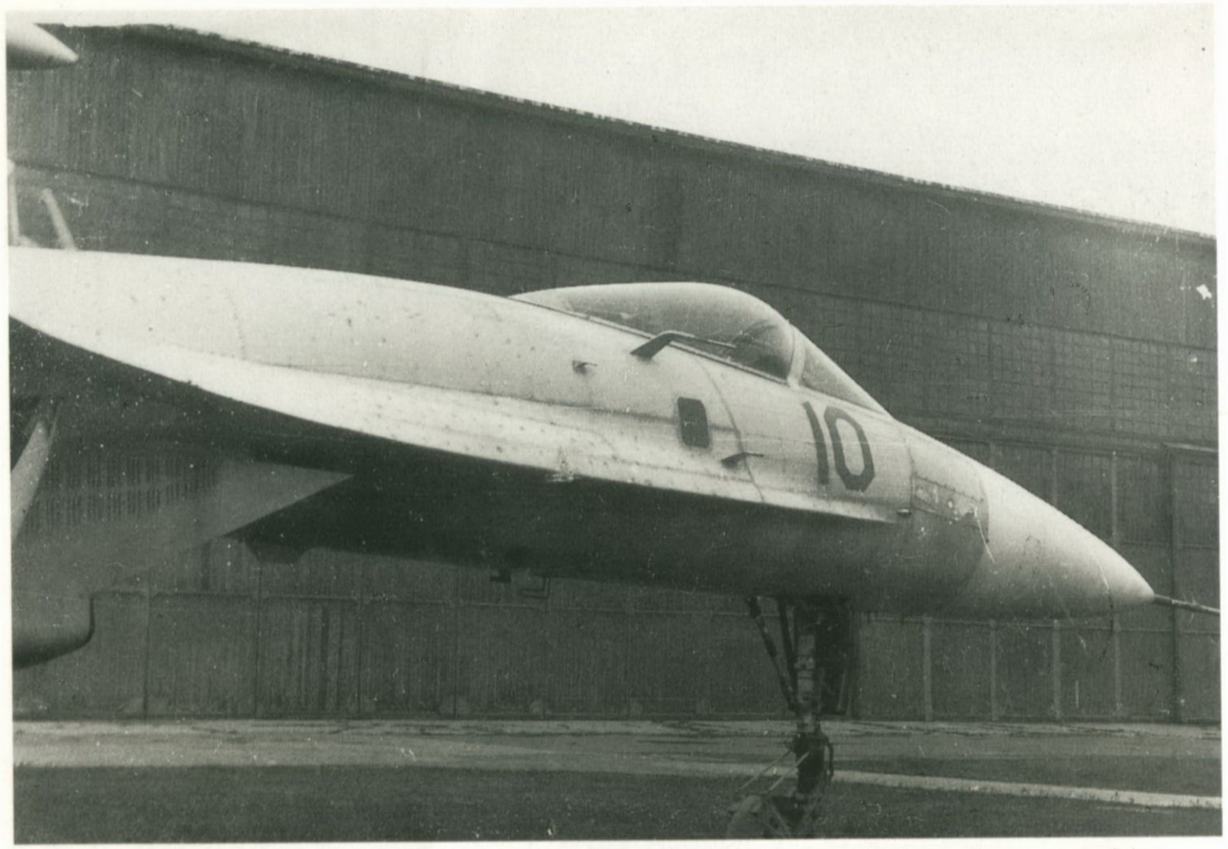
A MIG-29 of the Czechoslovak Air Force. The aircraft numbers are carried on the vertical tail rather than on the air intake unlike the Soviet practice.

A NVA pilot examines his aircraft during pre-flight. It is probably the last fighter type to enter German service carrying the NVA emblem. One wonders when it might be replaced by the German maltese cross? (Hans-Heiri Stäpfer)



Czechoslovak MIG-29UB number 4401 during flight. In the wake of the political changes in central Europe in 1990, the Czechoslovak government tried to cancel future purchases of the MIG-29.

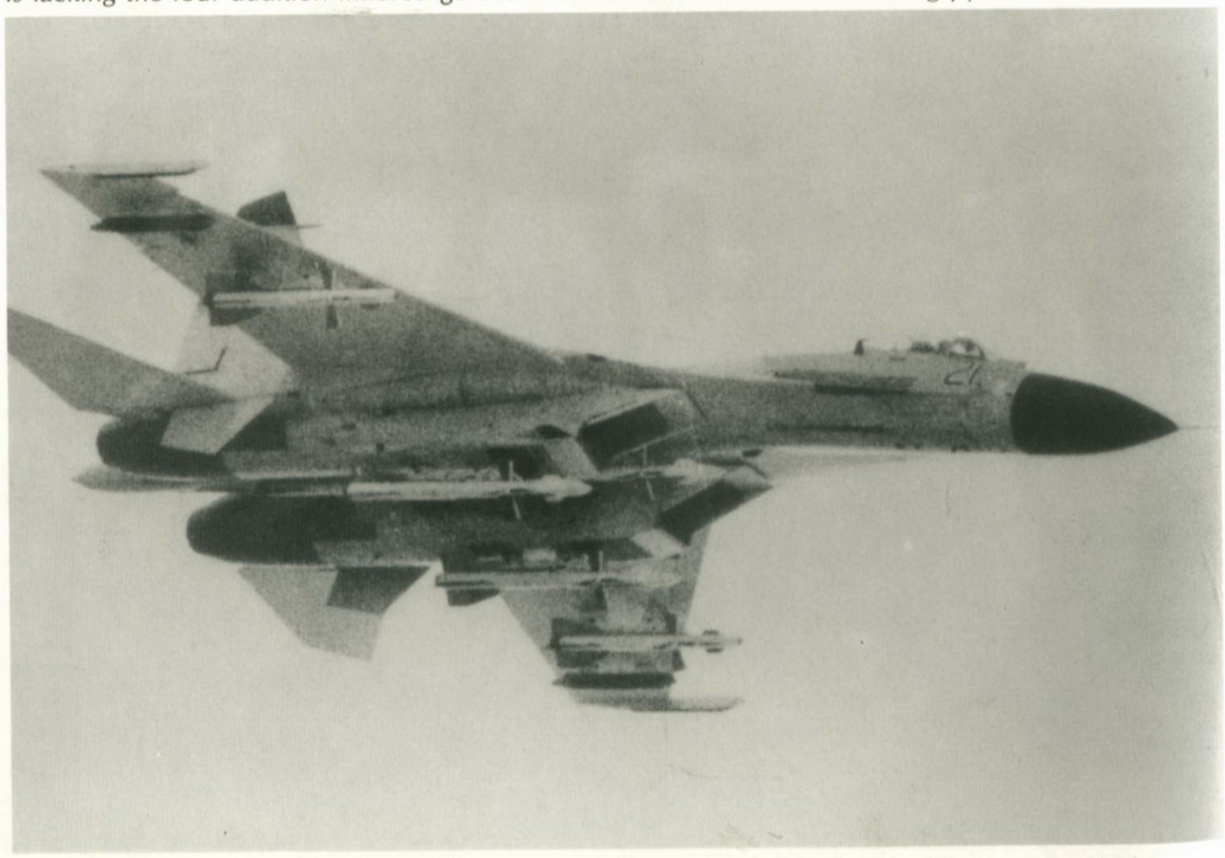
On this view of a Czechoslovak MIG-29UB, the combing around the edge of the cockpit is very evident. This is a pale pink sealant.



The T-10 was the prototype for the Su-27. The design failed to match the performance of the American F-15 Eagle, leading the Sukhoi bureau to completely redesign the aircraft as the T-10-21. This nose view of the T-10 prototype at the Soviet Air Force Museum at Monino shows the differences with the production aircraft.

The Sukhoi Su-27 is finished in a three-tone camouflage pattern of two-shades of sky blue and a pale grey. This scheme has led to its unoffical nickname in Soviet service: Azure Lightning.

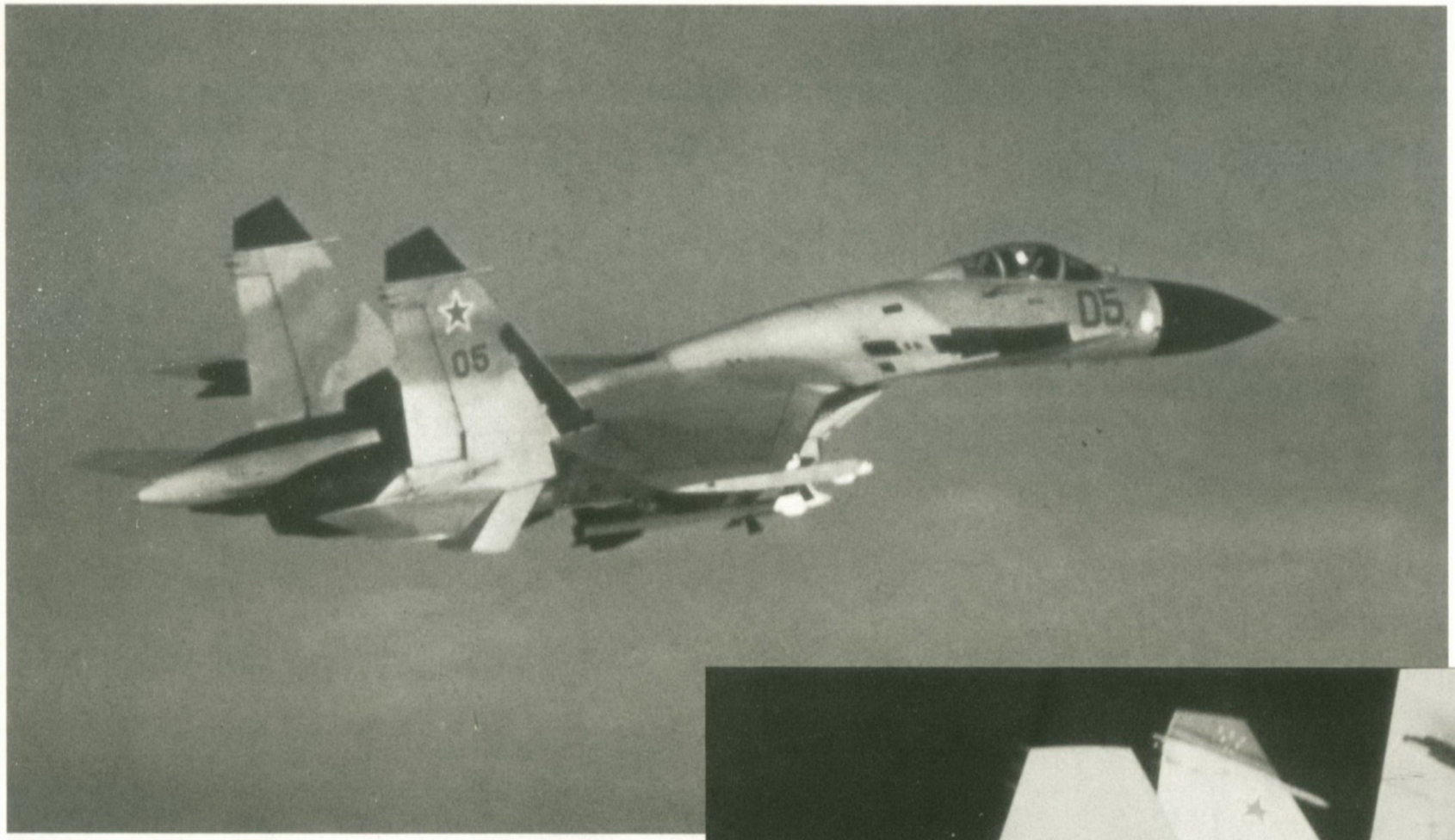
The Sukhoi Su-27 Flanker A was originally requested for the Soviet Air Defense Forces and was initially deployed in this role. This aircraft is armed with six R-27 (AA-10 Alamo) missiles, but is lacking the four addition infrared guided missiles carried on the outer wing pylons.



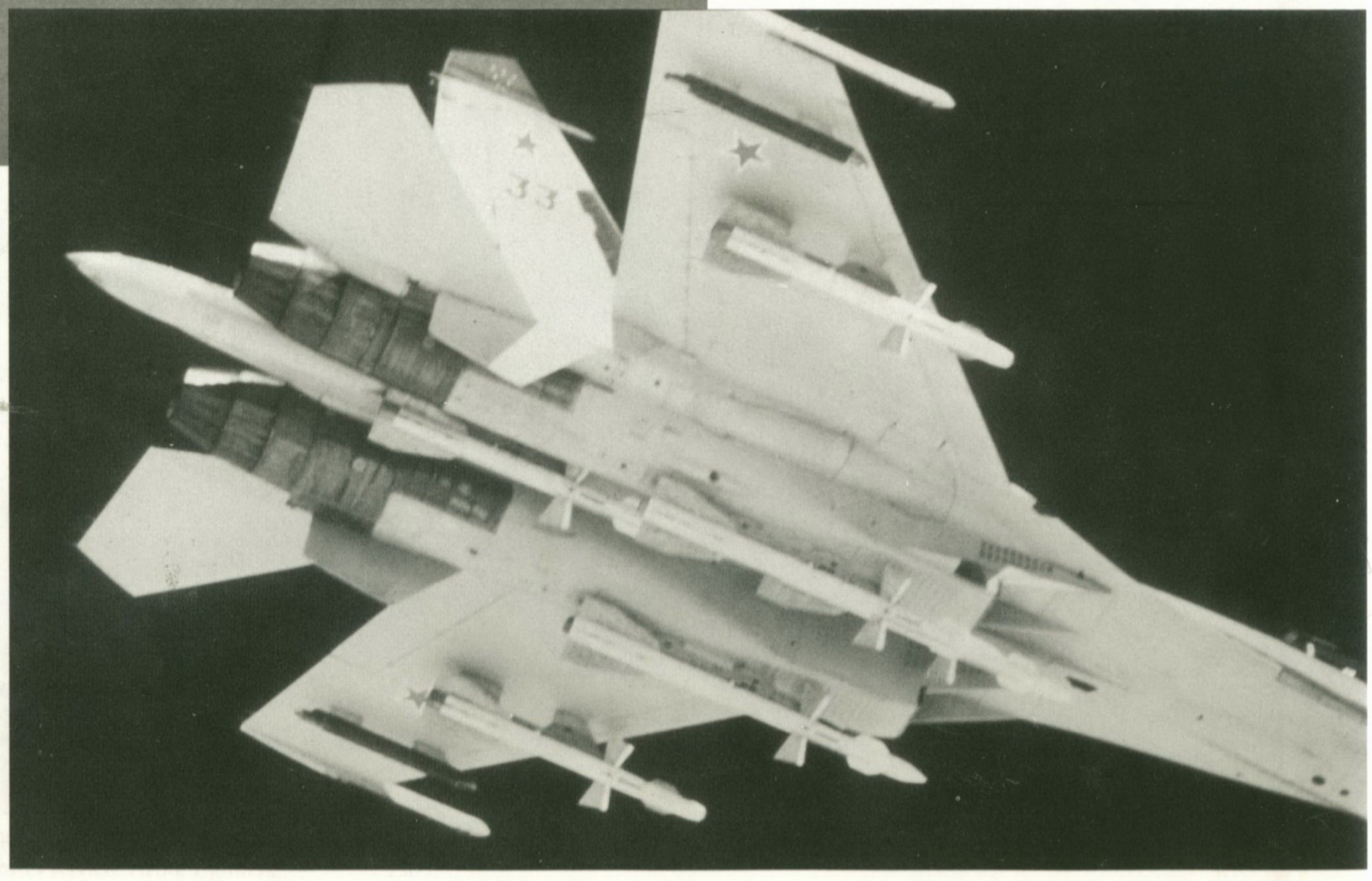
Another view of a PVO Su-27 intercepted by the Norwegian Air Force while operating in the far North. The Su-27 did not begin to show up with its additional R-73 (AA-11 Archer) missiles until 1989.

◀ An interesting undersurface shot of the Su-27 showing its general configuration. This configuration was developed in conjunction with the Soviet TsAGI institute, one of the reasons for the similarity in shape with the MIG-29. However, the Su-27 is substantially larger.

▲ The Su-27 displayed at LeBourget comes in for a landing. This aircraft lacks the usual weapons pylons. Very evident in this view is the large airbrake behind the canopy, a concept inspired by the F-15 Eagle.



An Su-27 of a PVO regiment intercepted by the Norwegian Air Force in 1987. With the decline of the PVO, the Su-27 has also been adopted by the regular Air Force (VVS), being employed as a deep interdiction/escort fighter with the operational air armies. In this role, it would assist Su-24 Fencer strike aircraft in penetrating hostile air defense networks and defending them against fighter attack.



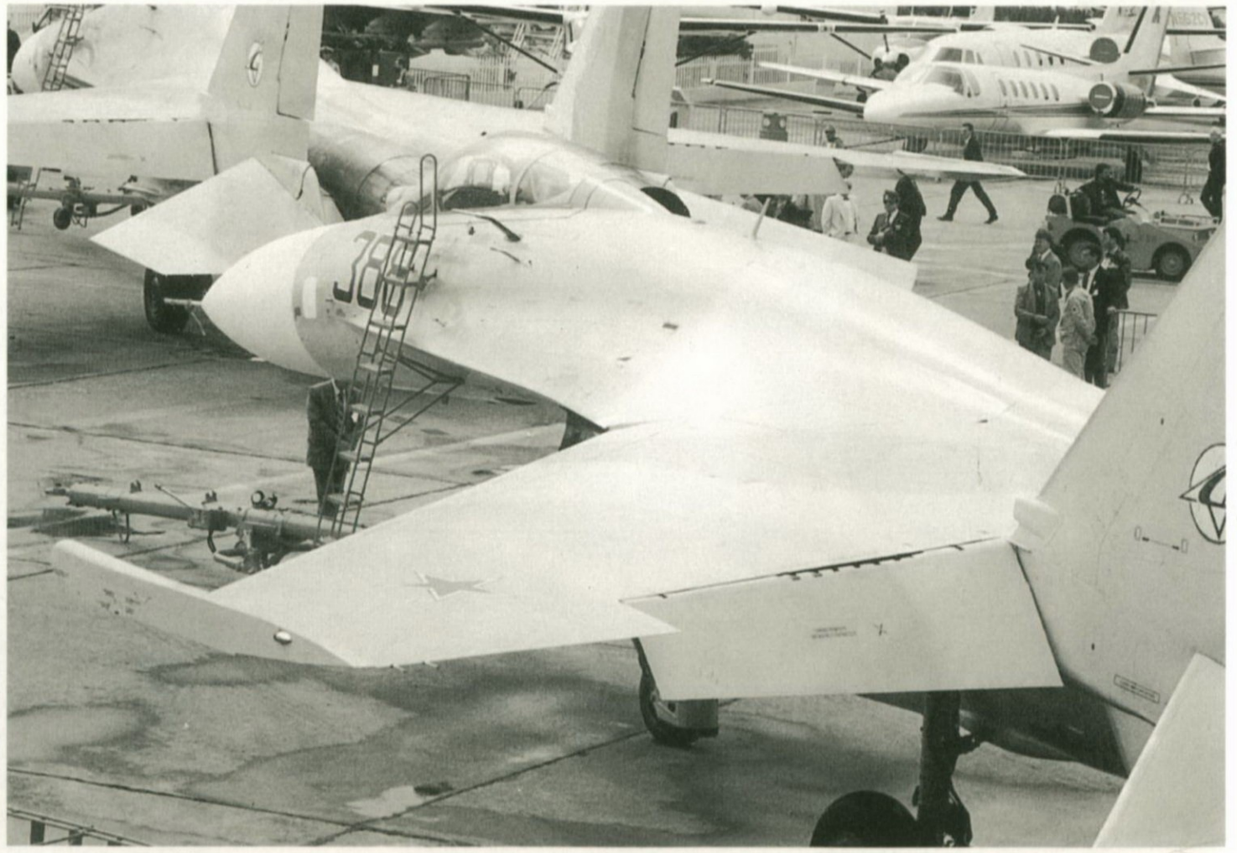
An underbelly view of a well armed Su-27. The AKU-470 pylons on the air intake tunnels and in the channel between the engines carry the extended range versions of the R-73 missile. The missiles on the APU-470 pylons on the wings are the shorter ranged, infrared guided AA-10 Alamos.

An Su-27 Flanker comes in for a landing with its air brake extended. (S.Zaloga)

A pair of Su-27 Flankers at Elmendorf AB in the United States. (USAF)

The Su-27 in flight. This aircraft is popularly called the ''Azure Lightning'' by its Russian pilots. (USAF)

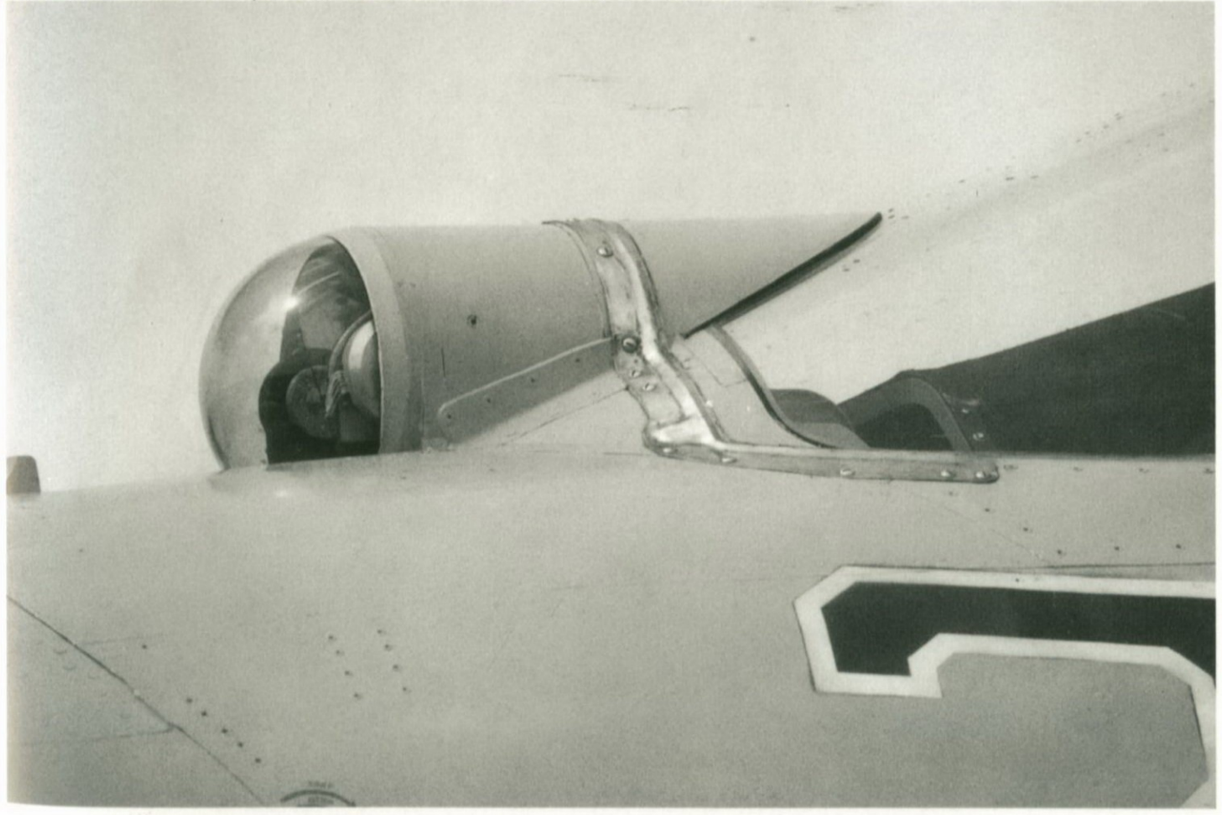
The Su-27 at Le Bourget in 1989. The ground handling equipment is Soviet, and is painted in a red-orange color.



An overhead view of the wing and forward fuselage. One of the noticeable features of the Su-27 was the relatively finer surface of the panels compared to the MIG-29.

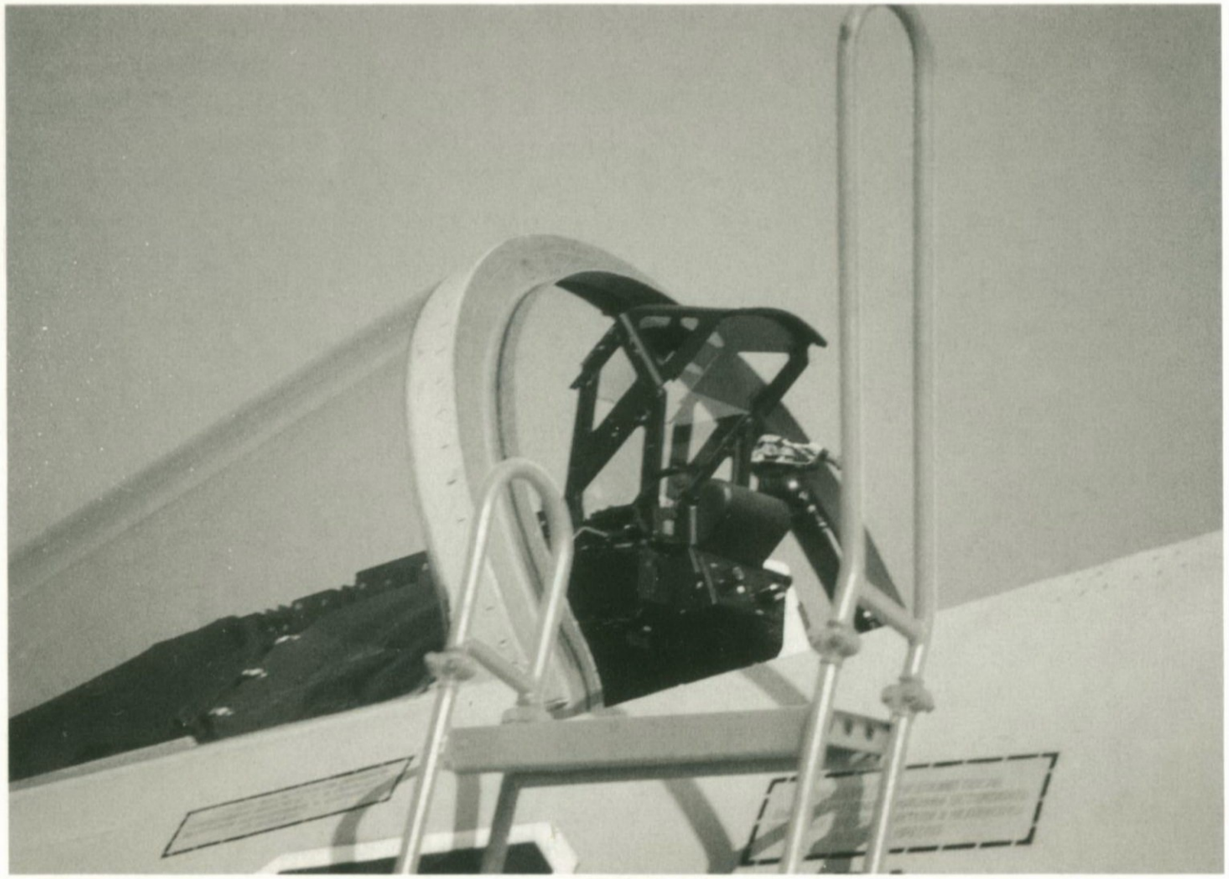
A side view of the canopy of the Su-27. On the side of the fuselage below the canopy is the name of the Sukhoi teat pilot flying this particular aircraft, V. Pugachev. Soviet Air Force fighters never carry the names of the crew. Pugachev is the originator of the dramatic "Pugachev Cobra" maneuver that so captivated the crowds at the 1989 Paris Air Salon.

A view of the right side of the Su-27 canopy. Evident in this view is the GSh-30-1 30mm cannon and the extensive stainless steel blast panels adjacent to it.

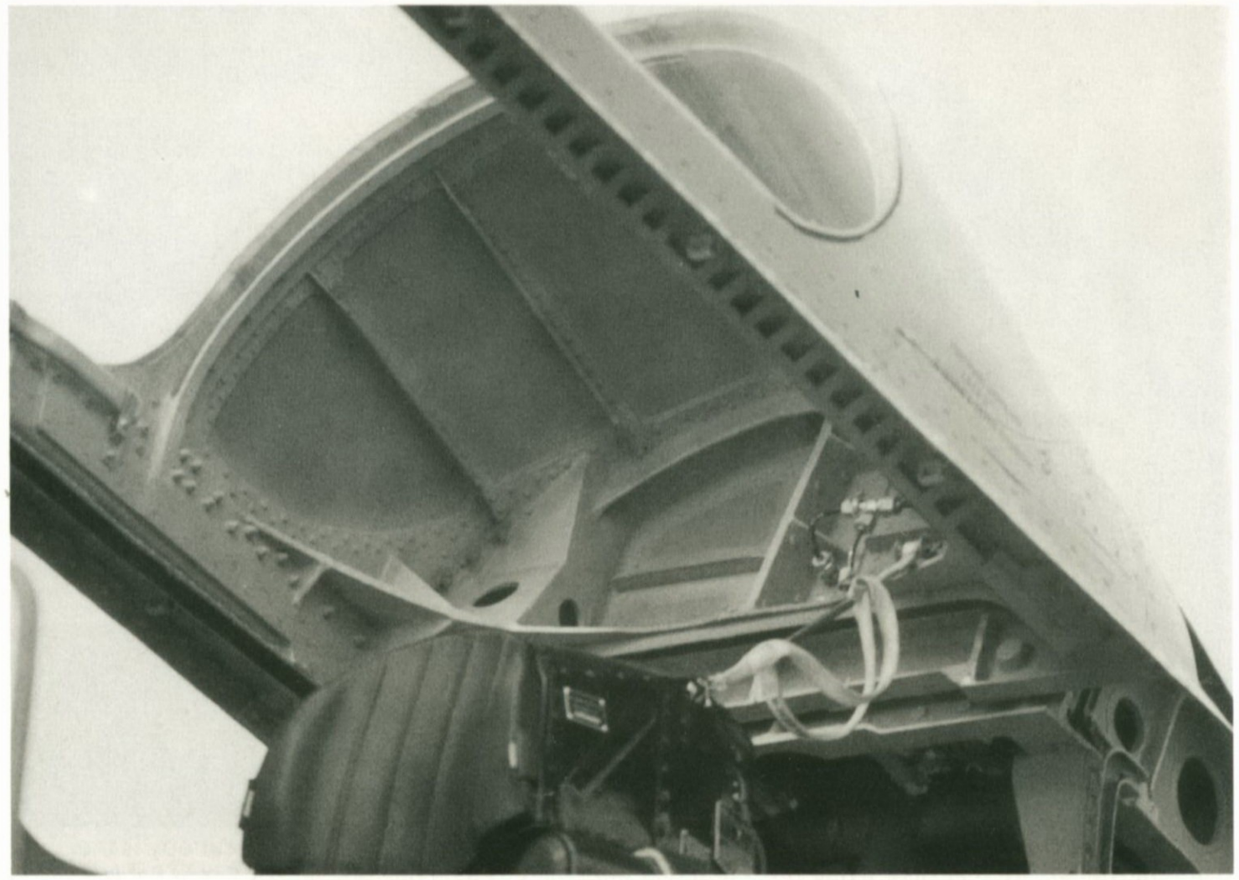


As in the case of the MIG-29, the Su-27 is also fitted with a Sh-1 infrared search and track system. Unlike the MIG-29, it is mounted on the centerline, not off-set to the side.

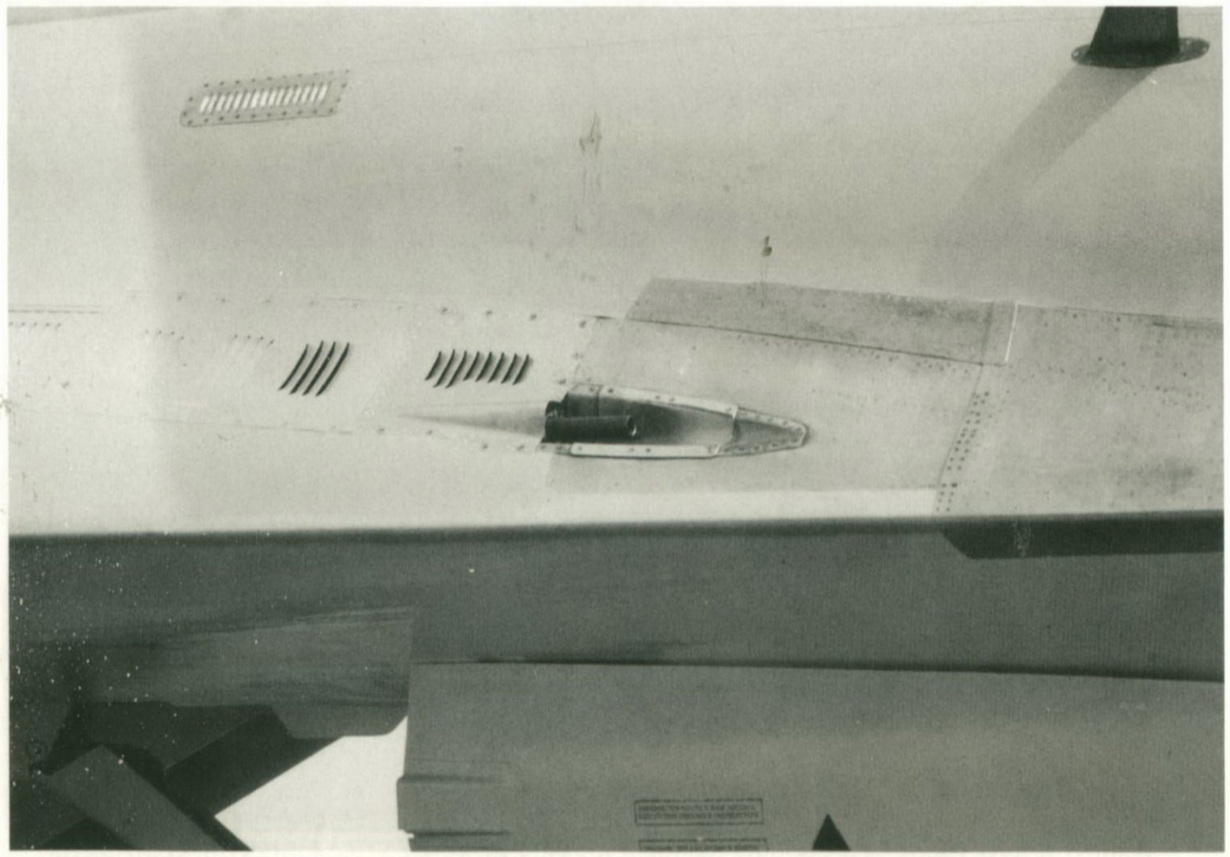
A close up of the front of the canopy showing the Sh-1 IRST sight. Also evident is the aircraft's head's up display.



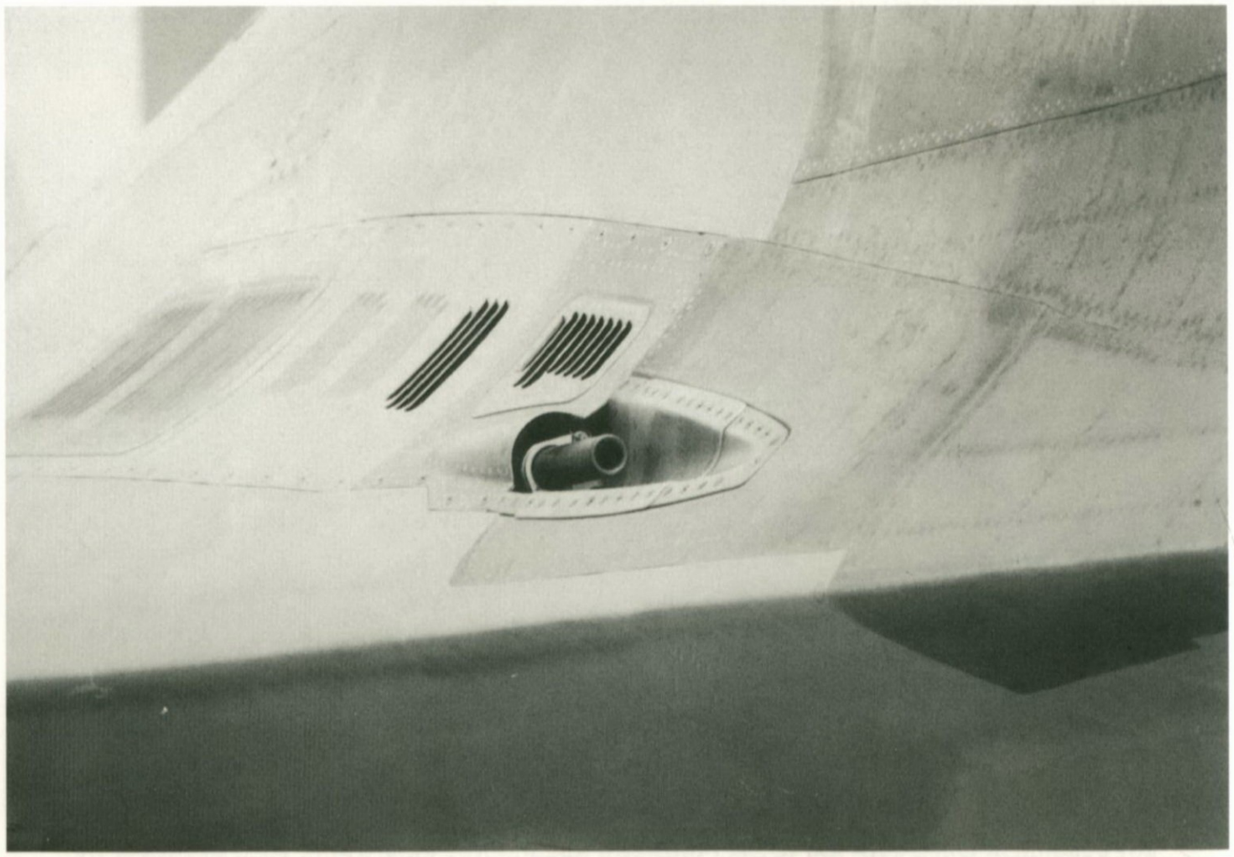
A close up of the heads-up-display (HUD) in the Su-27 Flanker.



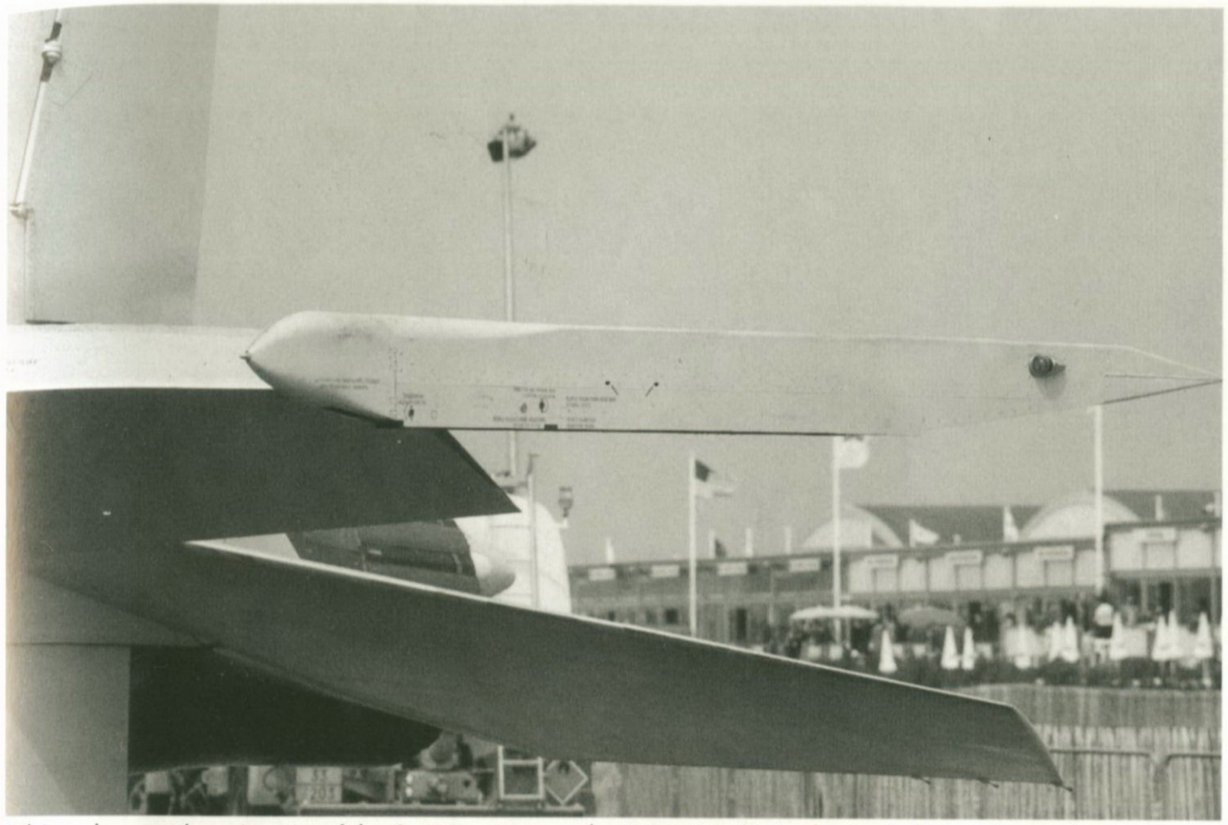
A close-up of the interior of the cockpit-canopy.



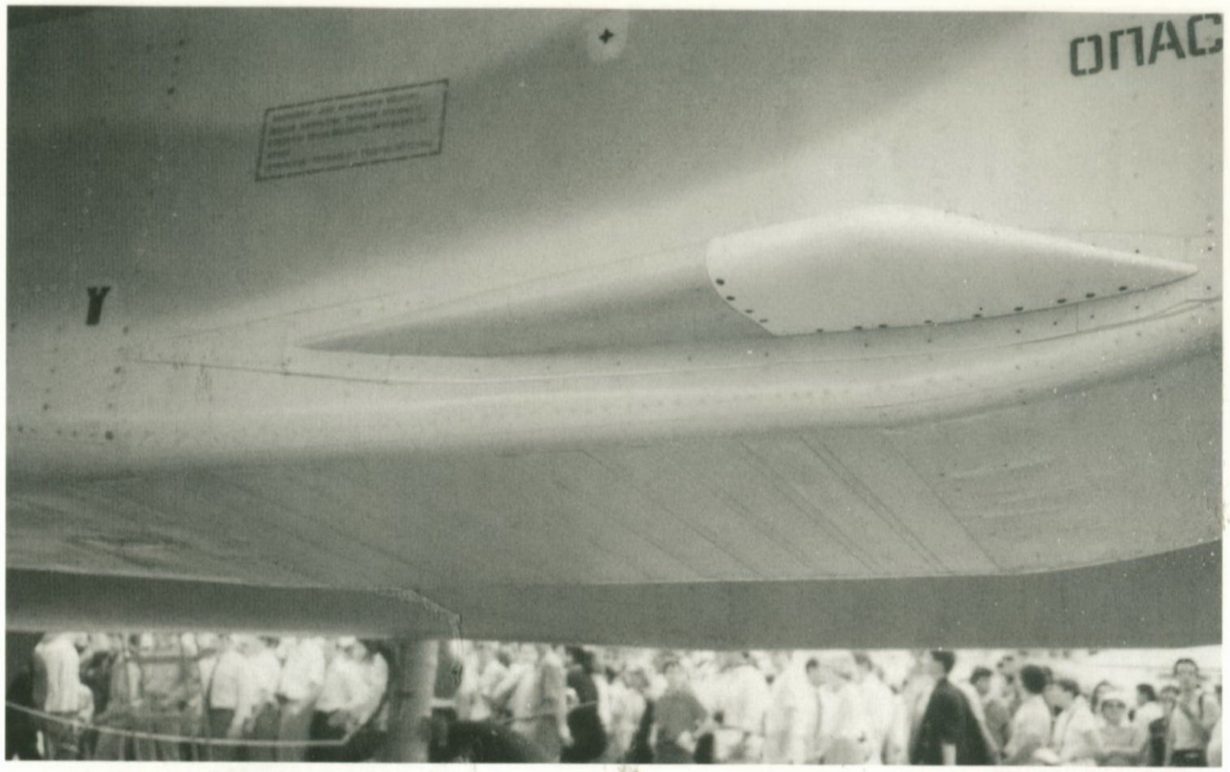
A close-up of the GSh-30-1 gun port on the right side of the Su-27 fuselage.



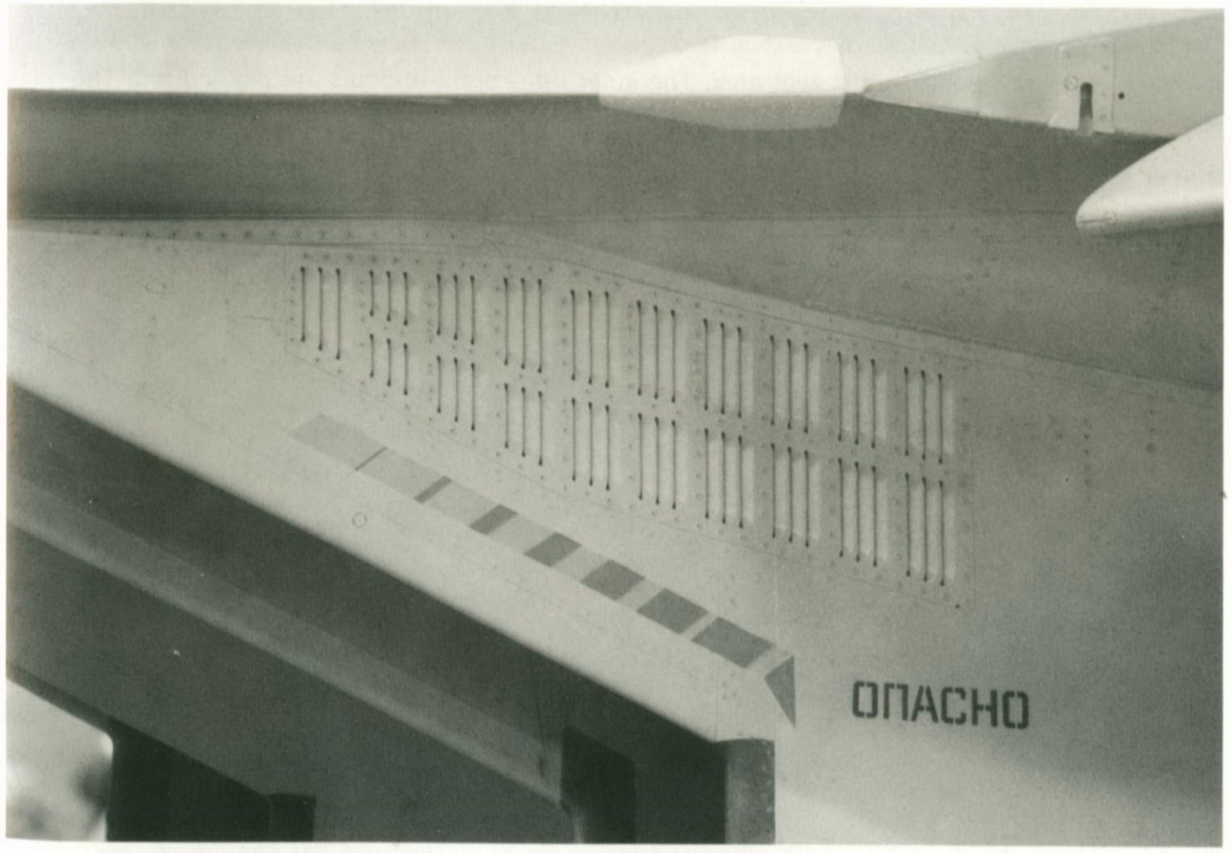
Another view showing the GSh-30-1 30mm autocannon fitted to the Su-27.



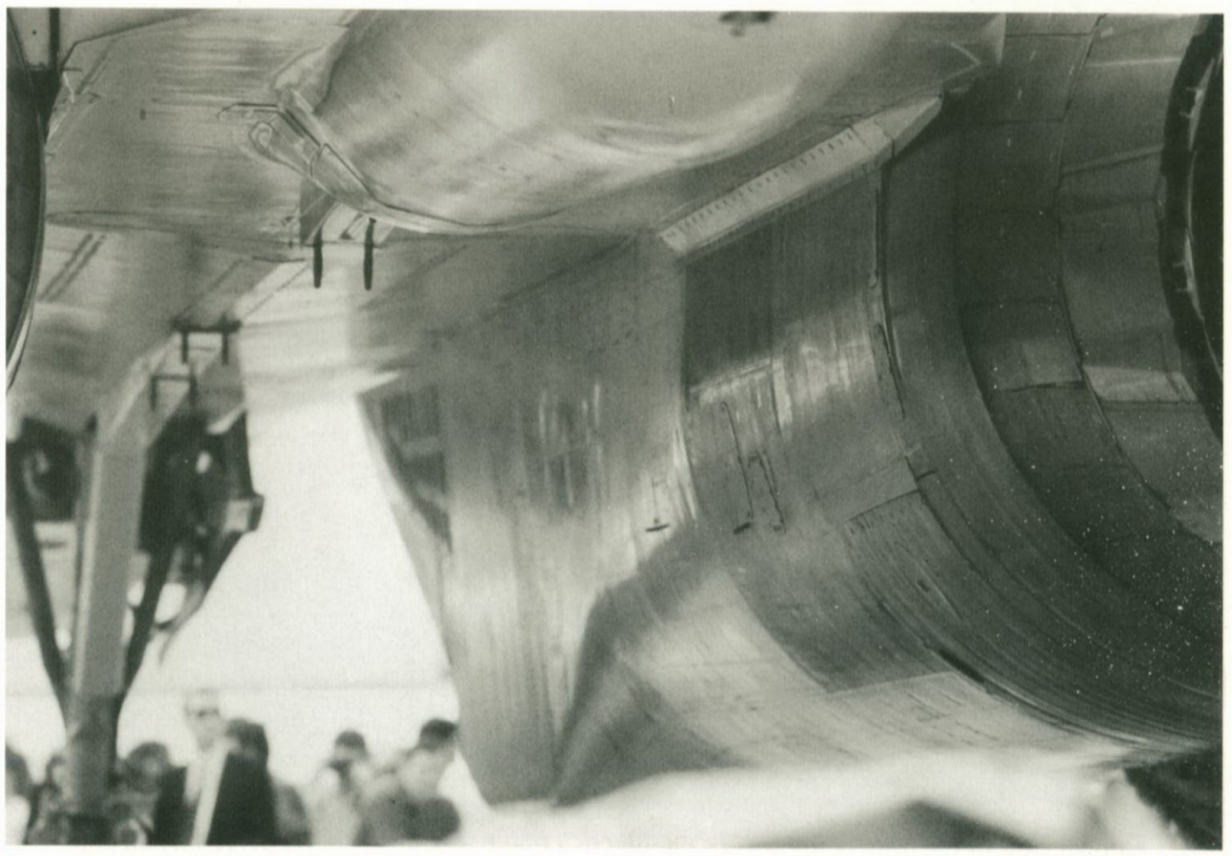
This pylon on the wing-tip of the Su-27 can carry the R-73 (AA-11 Archer) missile underneath.



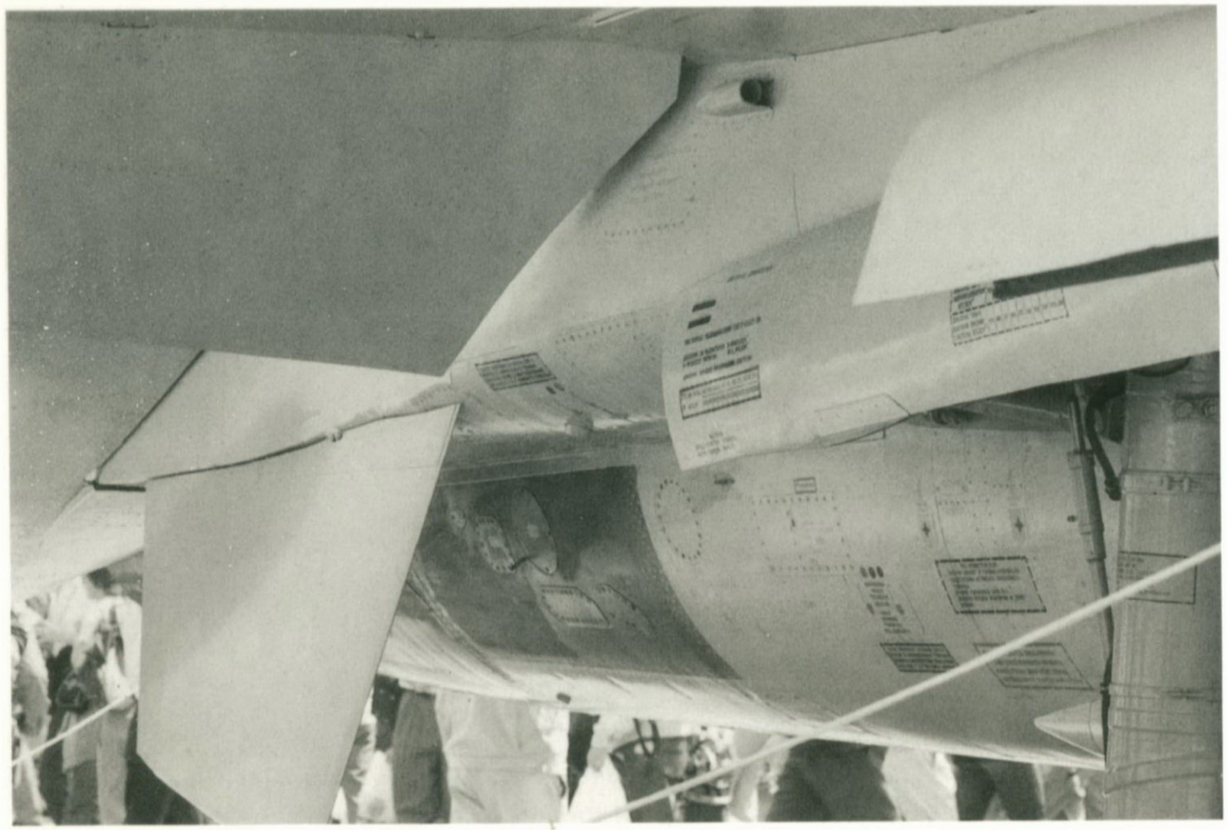
Associated with the anti-FOD system and air regulation system is a series of slotted air intakes under the air intake tunnels. They are closed in this view, and therefore, difficult to see. The fairing evident in the center of the picture is an antenna for the electronic warfare warning system. The forward portion of this antenna is a white dielectric material.



A close-up view of the air flow control vents on the side of the air intake. The yellow and red warning stripe along the lip of the intake is evident in this view, as well as the "OPASNO" warning label.



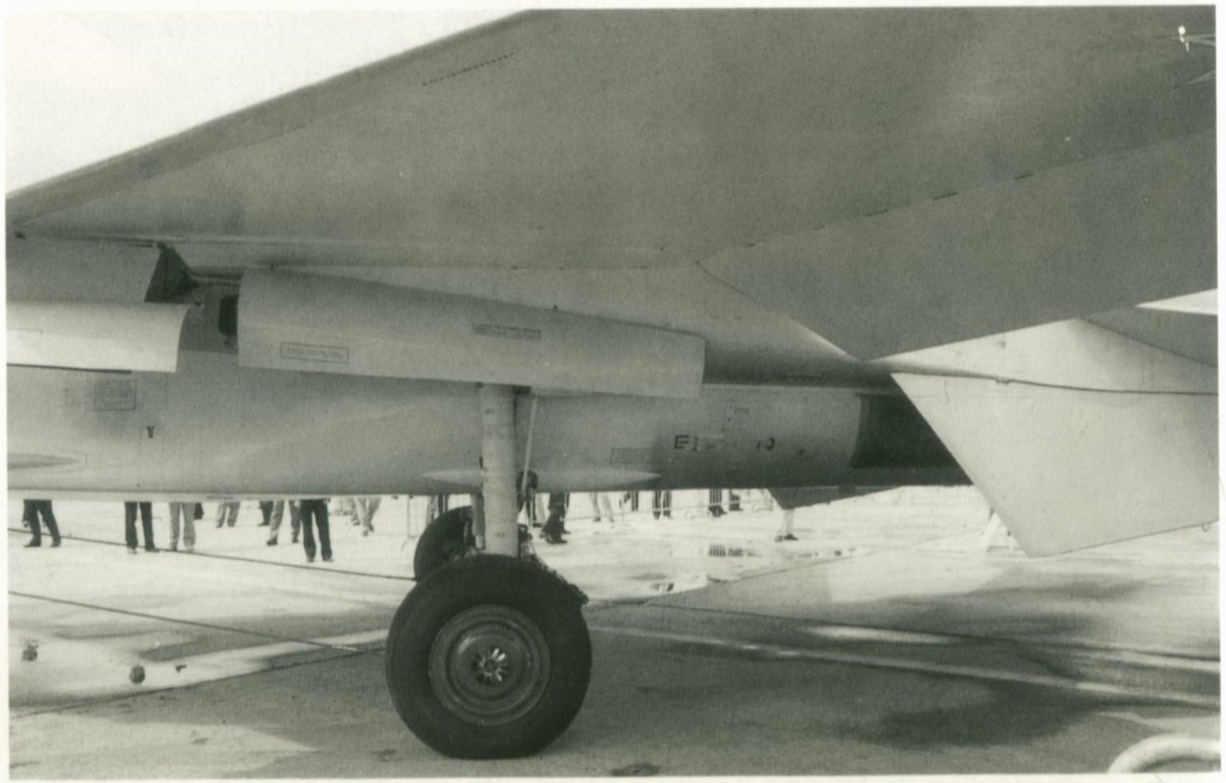
A view down the channel between the two AL-21F engines. The pairs of vertical pins are attachment points for type-470 missile pylons.



A view under the right wing. To the left can be seen the ventral fin while to the right is the main landing gear assembly. Note also the extensive maintenance stencilling.

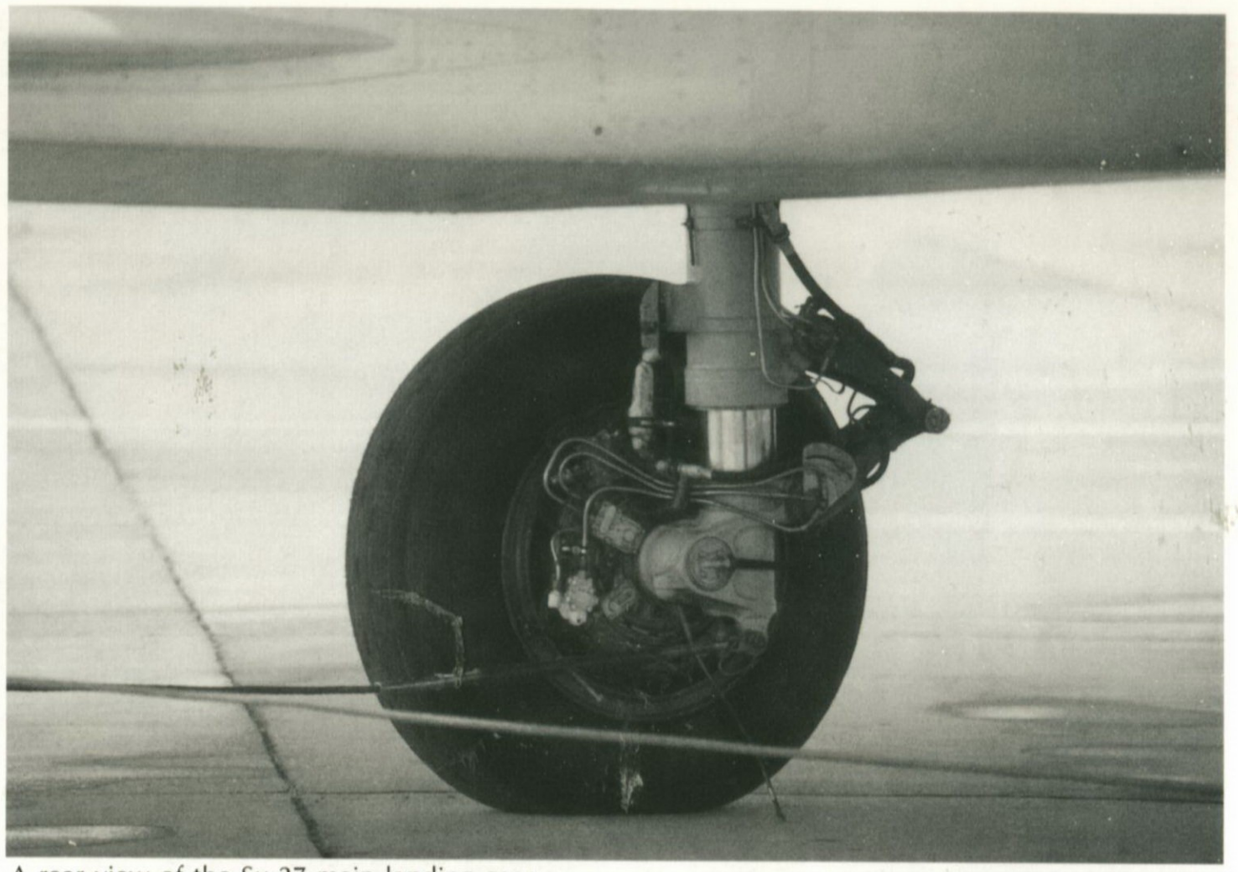
A detail view of the front landing gear, hitched to a tow-bar. The wheel is covered by an anti-FOD catcher, a typical feature on Soviet combat aircraft these days. Curiously enough, the interior of the front landing gear door is painted red.

A view of the right landing gear area. The inner sides of these doors are painted red. The leading edge of the wing has a small white RWR antenna.

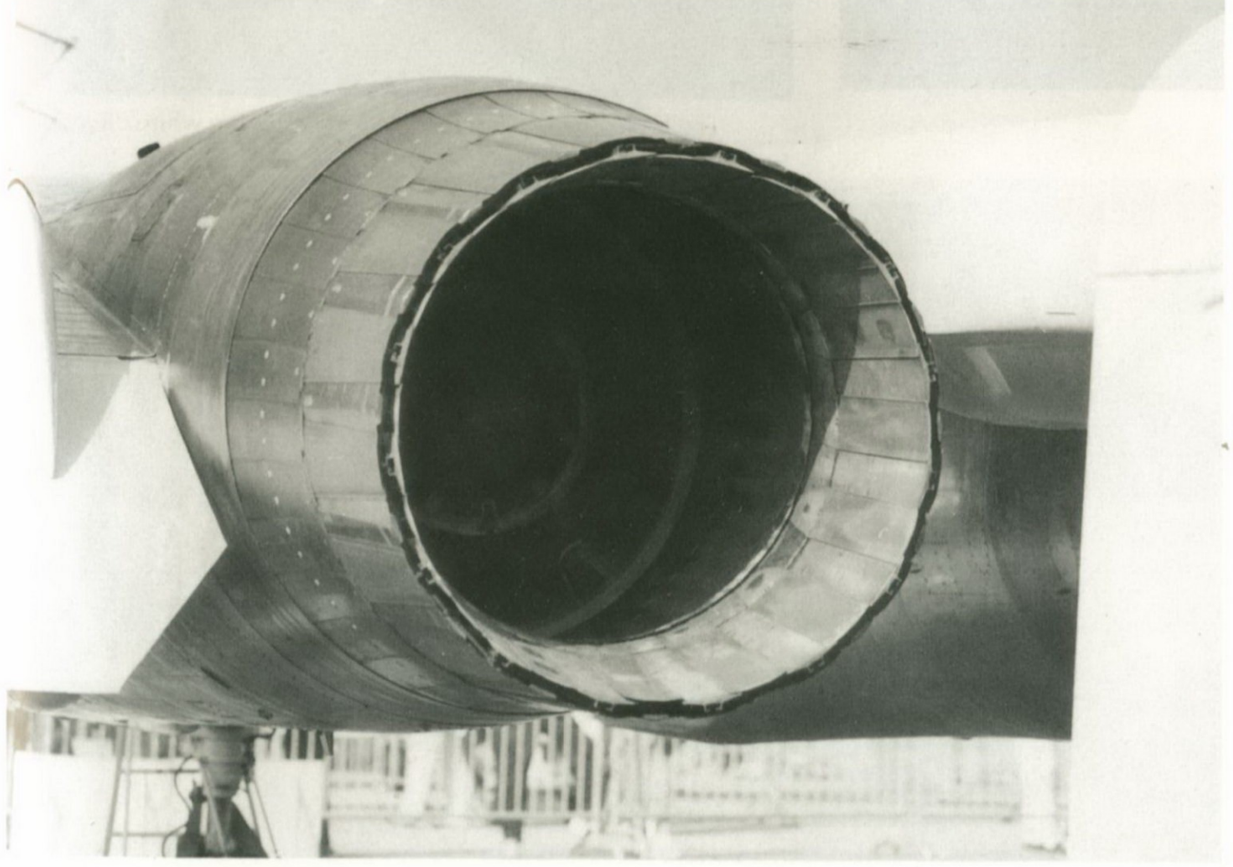


A profile view under the left wing showing the configuration of the landing gear doors.

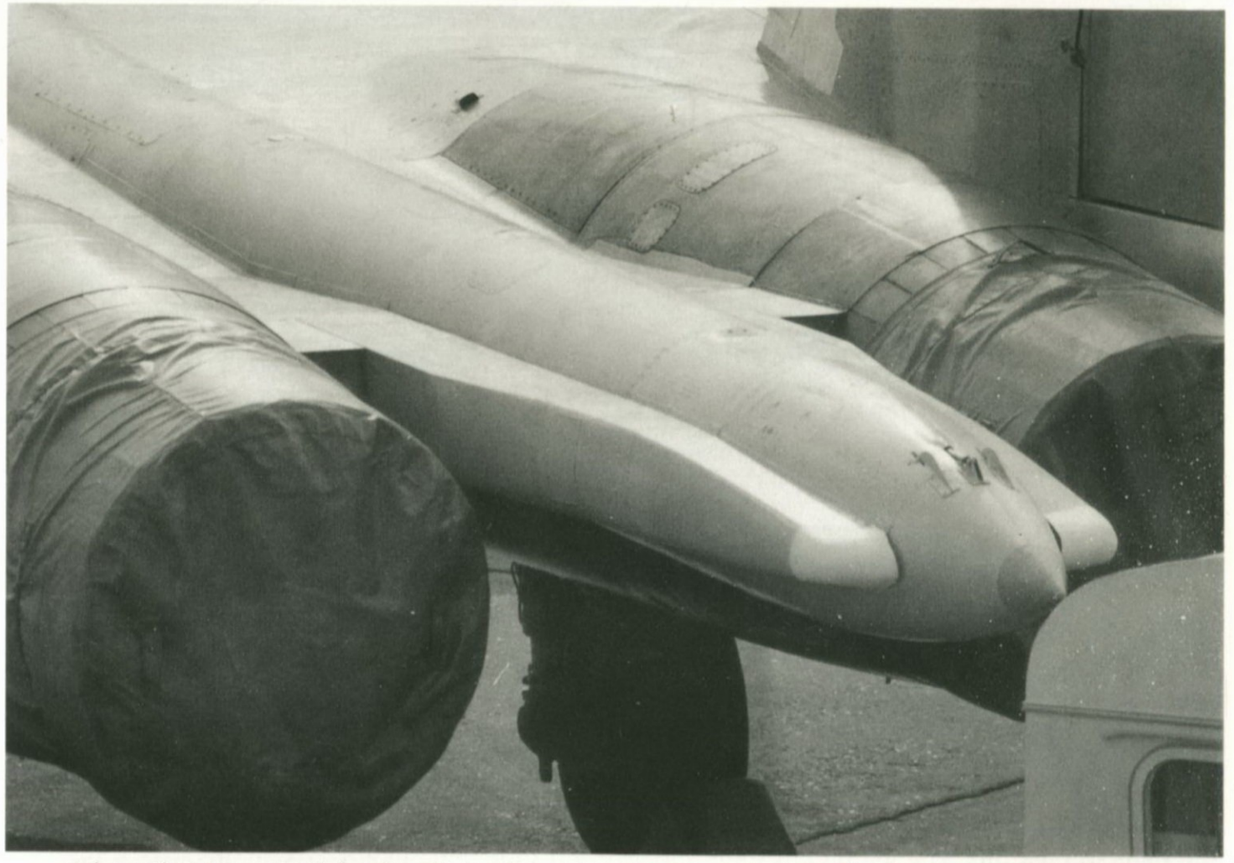
A close-up of the left landing gear. The wheel hub, as is standard Soviet practice, is painted dark green. The small antenna evident at the bottom of the engine in the right of the picture is a pale-orange-brown Khrom-Nikel IFF antenna.



A rear view of the Su-27 main landing gear.



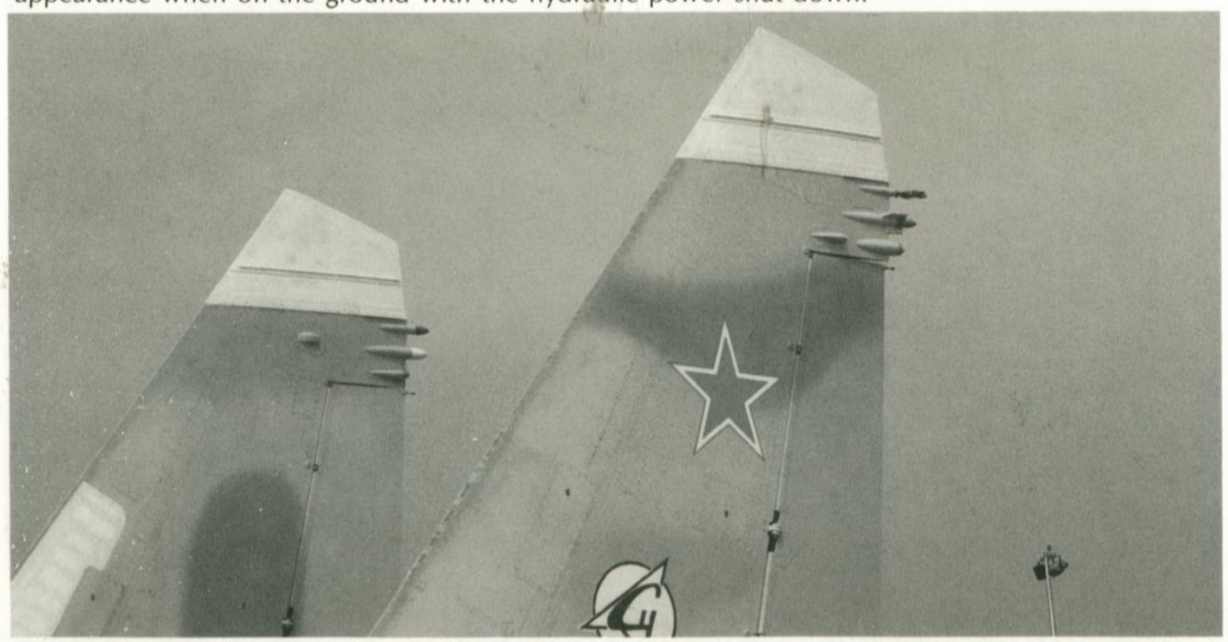
A closeup of the exhaust of the Lyulka AL-21F engine on the Su-27.



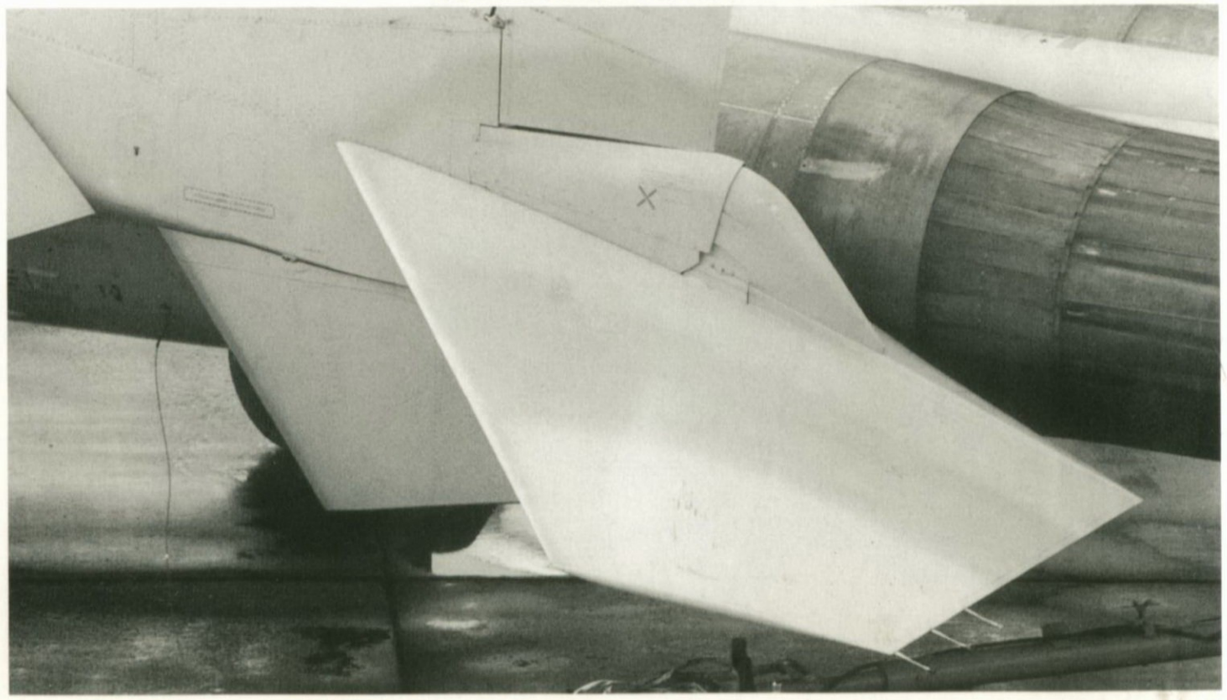
The tail "stinger" of the Su-27. In the center is a parachute brake housing, while the two channels on either side are capped off by rearward pointing radar warning antennas.

A rear view of the Su-27UB trainer. The tail and flaps take on this characteristic droopy appearance when on the ground with the hydraulic power shut down.

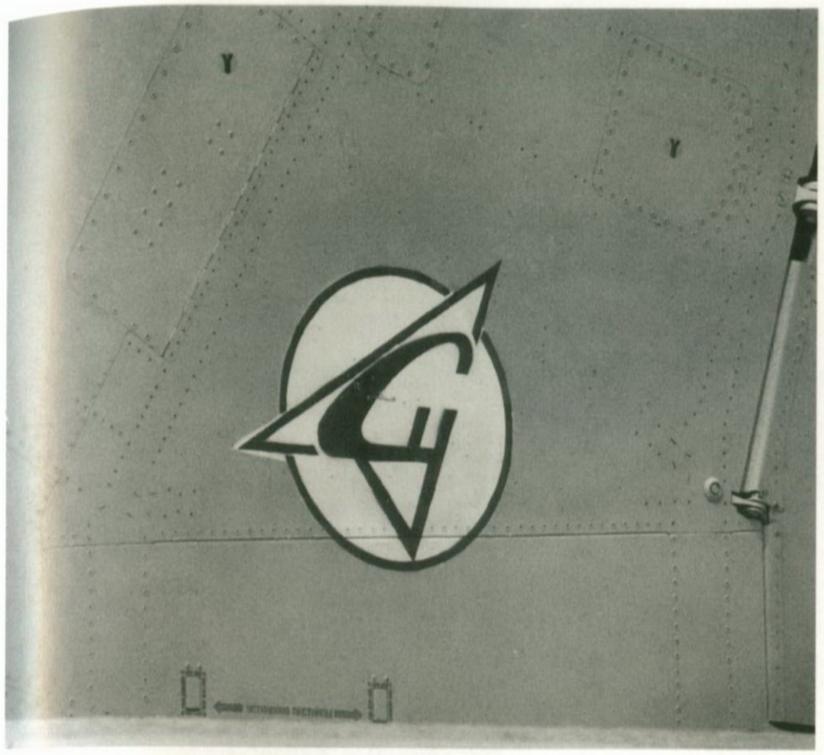
The left vertical tail of the Su-27. The tip is a white dielectric material for use with internal antennas.



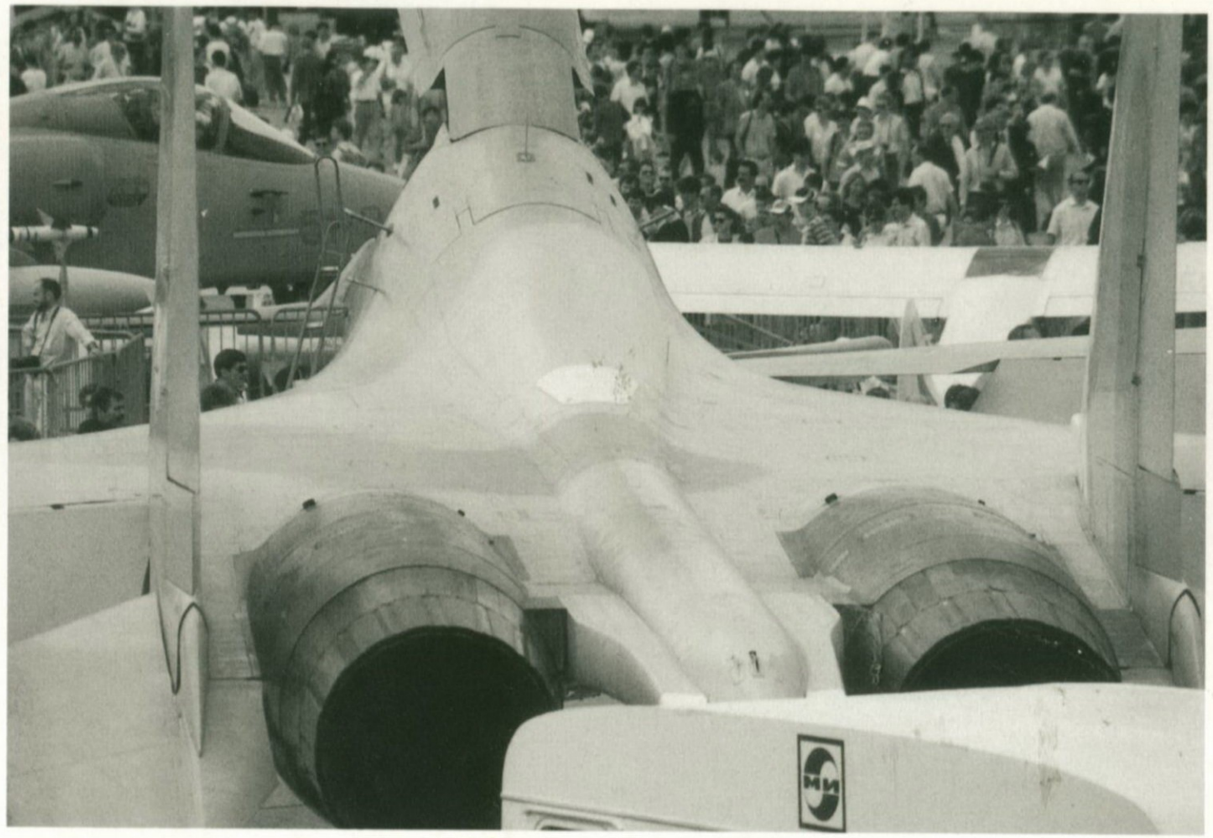
This view of the twin tails of the Su-27 illustrates the slightly different antenna array between the right and left fins. The left fin has the distinctive instrumented landing system antenna at the top, and both fins have rearward pointing radar warning antennas. The lower leading edge of the right fin is white dielectric material covering forward pointing antennas, while the left fin is metal.



The tail stabilizer on the Su-27, with the ventral tail fin evident in front of it.

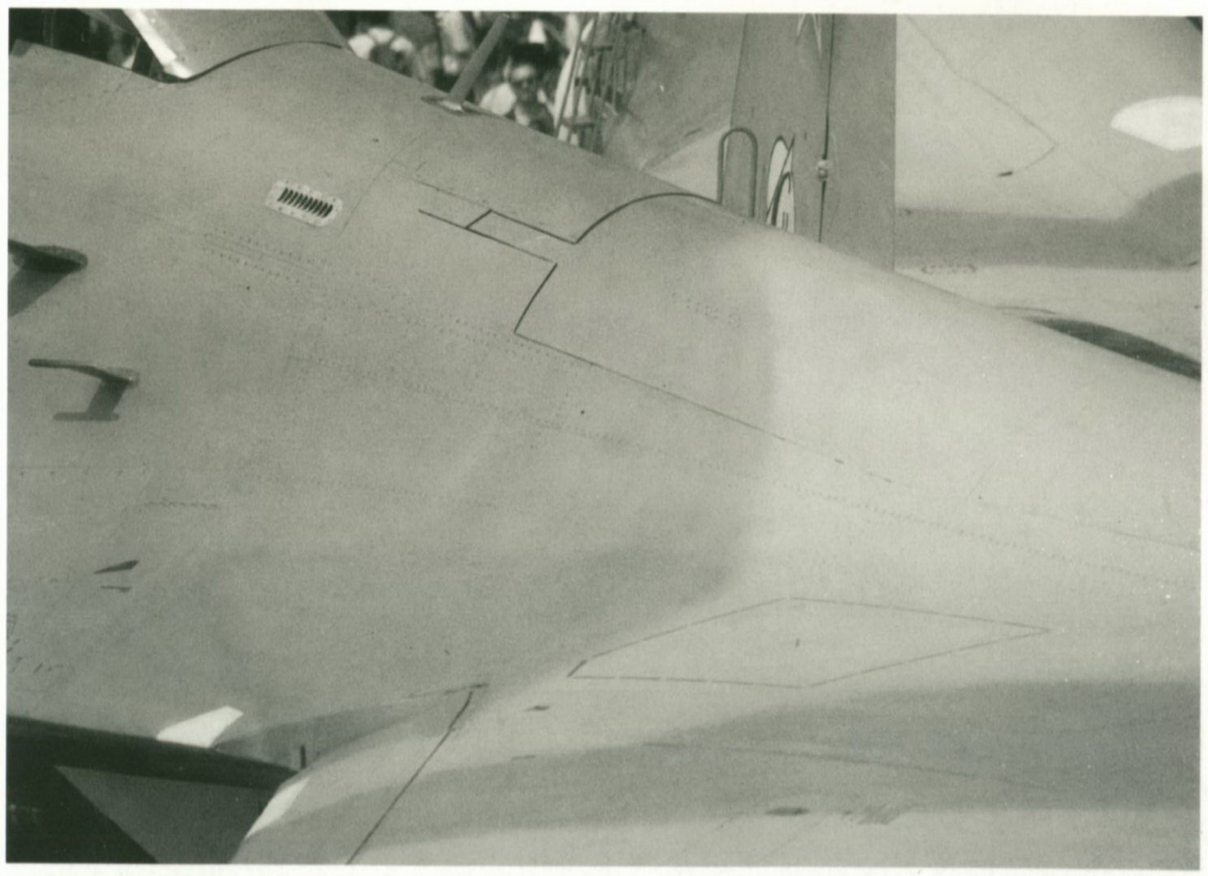


A close-up of the blue-and-white P.Sukhoi Experimental Design Bureau insignia.



A view up the spine of the Su-27. Note that the communications antenna covering at the center of the spine is white. On some aircraft, it is in a dark grey dielectric material instead.

A profile view of the vertical tail of the Su-27.



A close-up behind the cockpit showing the panel line detail around the large air-brake.

An Su-27UB in flight. (USAF)

An Su-27UB trainer with towing shackle on the front landing gear leg. (S.Zaloga)

Su-27UB during take-off. (S.Zaloga)

Su-27UB during a climb. (S.Zaloga)

Su-27UB trainer coming in for a landing. (S.Zaloga)

A profile view of the Su-27UB trainer. Unlike the MIG-29UB, the Su-27UB is fully combat-capable, as it is fitted with the same radar system as the fighter version.

A closeup of the Su-27UB trainer. The Soviets have examined the possibilities of developing ground attack and long-range interceptor versions in this two-seat configuration.

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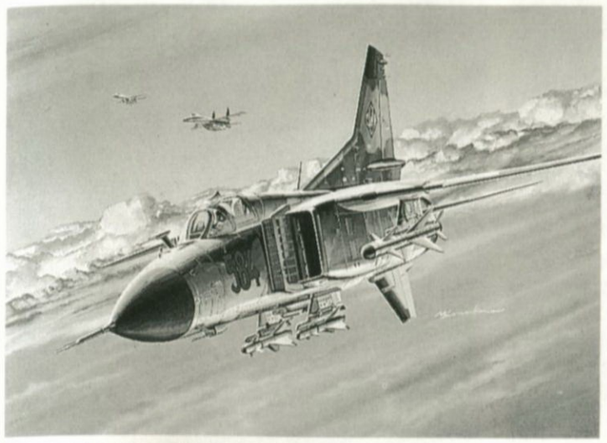

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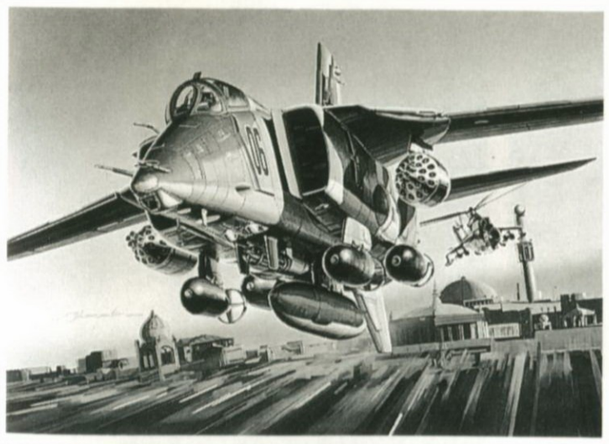

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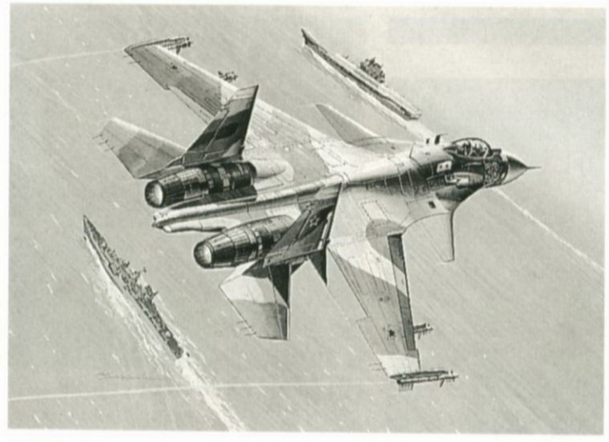

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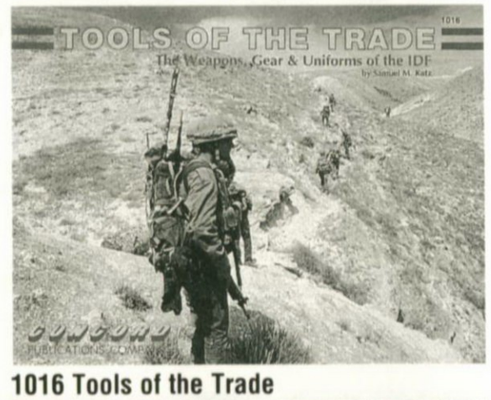

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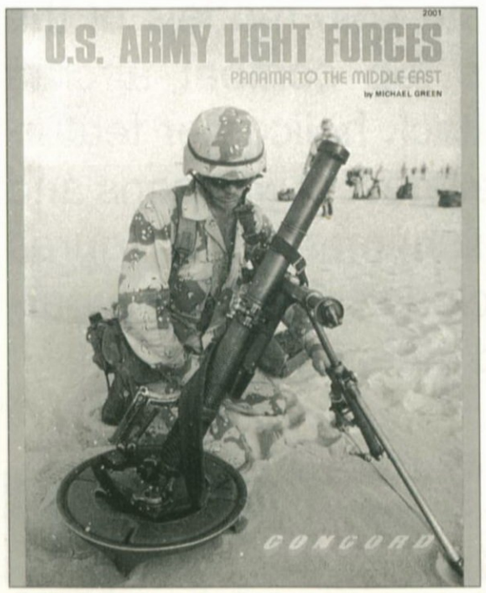

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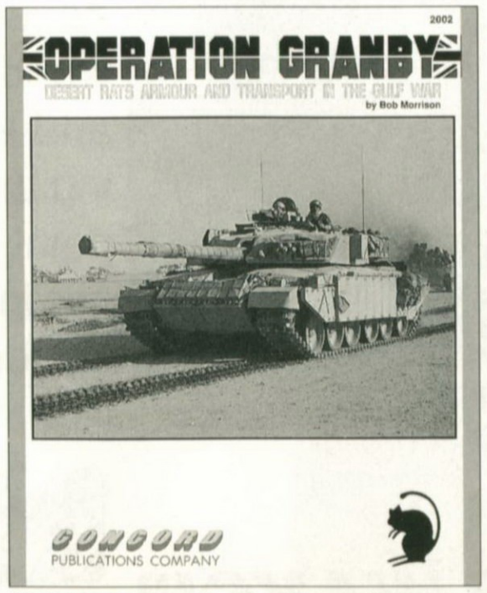

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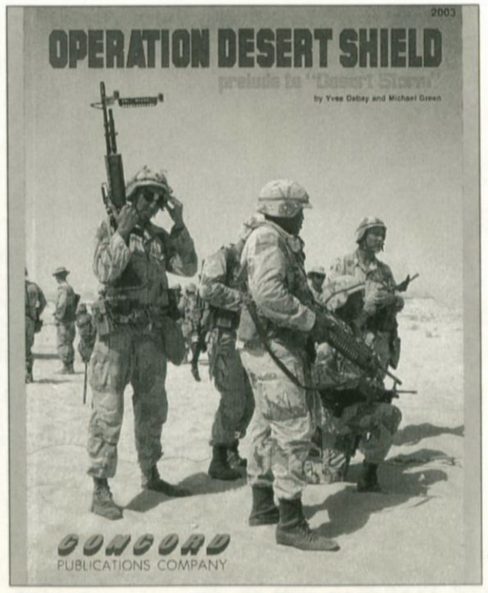

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